Your TRS-80 Can Speak 6502

June 1983 USA $4.00

80micro

A WAYNE GREEN PUBLICATION

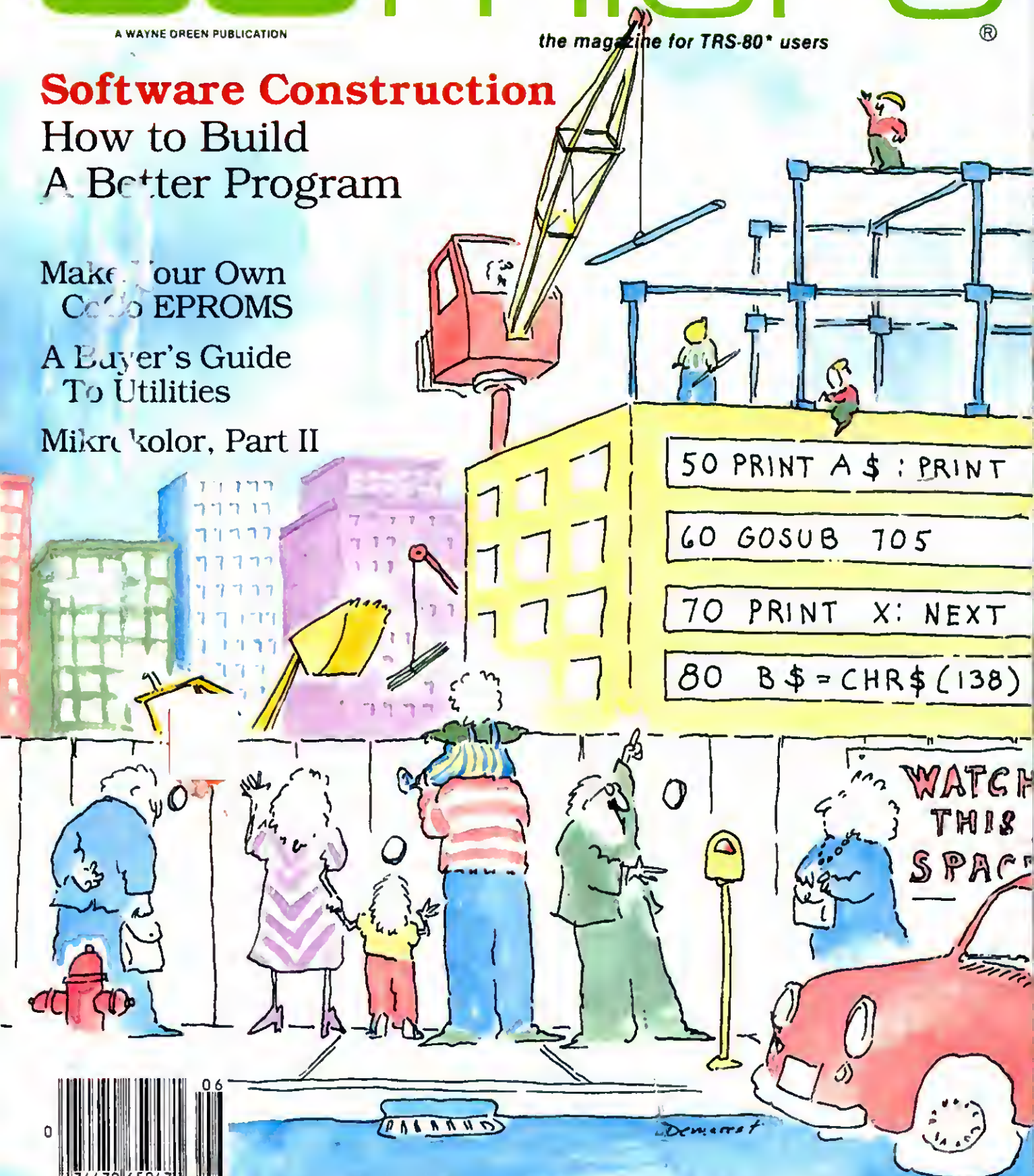
the magazine for TRS-80 users*

Software Construction
How to Build A Better Program

Make Your Own Code EPROMS

A Buyer's Guide To Utilities

Mikrokolor, Part II



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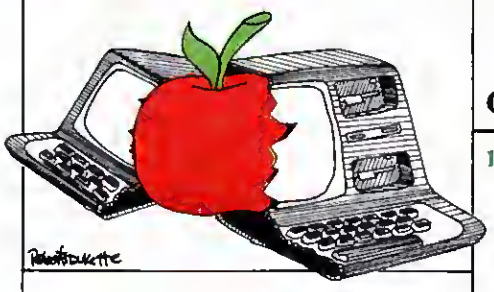

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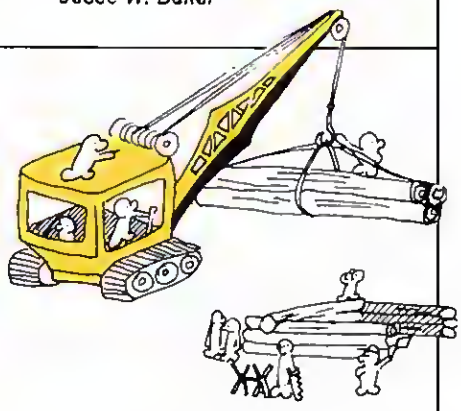

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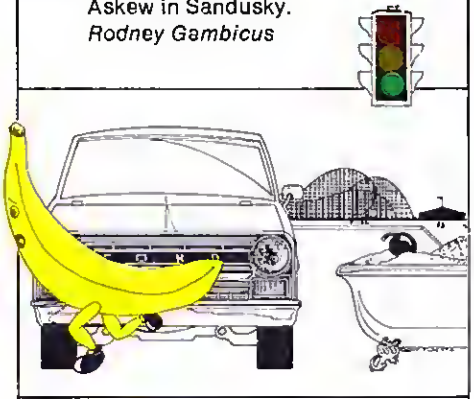

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80 formats its program listings to run 64-characters wide, the way they look on your video screen. This accounts for the occasional wrap-around you will notice in our program listings. Don't let it throw you, particularly when entering assembly listings.

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Cover by Chris Demerest

REMARKS

by Wayne Green

Tandy—TV or not TV?

After watching *80-US* magazine cozy up to Radio Shack, I was surprised to see the editor finally turn and bite the hand that has been feeding him. And a vigorous bite it was...opining that Radio Shack has a "stodgy image." He wants them to plunge into a high-priced television battle with Texas Instruments, Apple, Atari, Commodore, and IBM. Oh tsk, tsk.

The Radio Shack decision not to pour millions into a television campaign and fight commercial-for-commercial may be a good one. Remember that the average consumer is unequipped to make a rational decision among the various computers. The fact is that it is often difficult to get experienced professionals to offer any clear guidance when it comes to computer selection. This will remain, for a while, more of a theological matter than one arguable with facts.

Radio Shack has for years depended more on local newspaper ads than national media. I'd say that as long as the bean counters can show they get more sales per invested ad dollar with co-op newspaper ads than they do with almost unmeasurable television ads, they should put their money where it does the most good.

No reputable ad manager is going to embark on a campaign without doing some tests first. With magazines, you try a relatively small direct-mail shot at a few subscribers and get an idea of what percentage you are going to pull. Then you buy your yearly ad contract, investing perhaps $50,000 or more. A test like this can cost as little as $500 and save tens of thousands.

Experimenting with television is a lot more expensive. The 30-second commercial can easily cost $25,000; some go to 10 times that. But the test to measure the impact in one area of the country is not a big deal...and, just as with the magazine ads, is well worth the actual cost before millions are invested in a national campaign.

Most firms make these local area tests first. I'm sure that Radio Shack is trying things like that here and there, looking for some formula that is a winner. Once they have an ad that pulls well for them, they can run it for the country and win big.

But I doubt if, as suggested elsewhere, trying to answer the claims of other manufacturers is appropriate. No, you sell your products best if you point out the benefits in your TV ads and get the folks into the stores to shop. If you really have a strong story to sell over other systems, then handle that in computer-oriented magazines—where people turn to make this sort of decision—and via literature in the stores.

Advertising is only a gamble if you don't know what you are doing. If you are working with an expert, you will find him testing every inch of the way before he puts up the big bucks. In that way, he'll know just about what sales a campaign is going to generate before he goes into it. A big outfit like Radio Shack, which does use TV around Christmas time, will use TV when they know it is the best thing to do, and not because some editor is whining for them to blow money.

There is some question about the need for trying to go head to head against T.I., Commodore, Atari, and the other low-end computer firms. I will be surprised if those firms don't knock each other out in a year, with no real winner. If Radio Shack can stand back and let 'em murder each other and aim more at the long haul, it may be the smart move. Of course, this is based on the guess that the el cheapo computers, without adequate information and software support, will go the way of the video game and hula hoop fads. Seems likely to me.

Those Antique Cassettes

The Load-80 programs have been produced in both cassette and disk form for several months. Despite the higher price, the disk sales have been increasing every month. Let's make a try at being reasonable about this whole thing, eh?

The purpose of the Load-80 program dumps is to save you an incredible amount of time typing in the program listings from *80 Micro*. With the Load-80 tapes you can load a good many of the programs from an issue of the magazine. This is a lot better than spending a couple of hours typing in the program and then several more extremely frustrating hours trying to find where you made your typing errors.

Now I'll grant you that getting Load 80 on a disk will allow you to load things a whole lot faster. But you're paying heavily for the convenience with the increased cost of the disk version. It's $10 more, which is the difference between the cost of a disk and a blank cassette...plus a bit additional because disks are more expensive to duplicate and package than cassettes.

One other factor that many users seem to overlook is the importance of the back-up disk. As soon as you get a disk, you want to make sure that you have a back-up, just in case. Okay, add in the cost of that back-up, too. If you'd bought the cassette version and loaded it onto part of a disk, you could put away the cassette and have it handy should anything blow up. The cassette is easy to store and index, and remarkably safe from the magnetic disasters that hit disks.

One of the favors the Apple people have not done for their users is getting rid of the cassette interface, thus automatically adding from $5 to $10 to the cost of *every* program bought. Radio Shack did a similar disservice to Model II owners. This was even worse because the system uses the even more expensive 8-inch disks.

There may be a market out there for a cassette interface board for the Model II (and for the Apple). It would pay for itself in a short while, first by cutting the cost of program interchange, and second by providing a much lower cost medium for storing data and programs that are not often used. I'd sure hate to put some valuable data on a disk for archive storage. ■

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Technology transfer and the micro

In a relative sense, microcomputer programming techniques have come a long way since the micro arrived.

But we too often assume that computers and programming did not exist before micros came along, that FOR... NEXT loops, multi-dimensional arrays, and editor/assemblers were devised by and for microcomputer users. The truth is that most programming techniques and languages were developed long before micros made the scene in 1975.

Another truth is that we microcomputerists have spent the last eight years more or less re-inventing the wheel, learning to do on micros what programmers of large computers were doing in the 1950s. This is one reason why minicomputer and mainframe people snickered at micros for so long. They had been using structured programming, subroutines, and arrays for decades and couldn't understand why micro programmers thought such techniques were something new and exotic.

What the mainframers failed to realize was that micros were being acquired by people with no formal training in programming. We learned as we went along, "discovering" concepts and techniques that had been in use for 25 years.

As more people became familiar with the intricacies of computer operation, they used their experience as a base on which to build their knowledge. Features and commands long a part of mainframe applications were adapted to the microcomputer and incorporated as programming options. As a result, today's micro capabilities are more sophisticated and powerful. Today the mainframers have stopped laughing. Micros have come into their own.

The business community is a good barometer of this. Applications formerly the exclusive domain of mainframes and minis, like data base management, accounting functions, production control, and economic modeling can now be effectively handled, albeit on a smaller scale, by micros.

Computing power has moved from the cloistered back rooms of data processing departments into the front office. Chris Christiansen of The Yankee Group, a Boston-based consulting firm, estimates that 4.8 million micros will be used in the office by the end of 1983.

But as micros proliferate in business, are their new-found capabilities utilized to the fullest? Tom Willmott, project manager of International Data Corp.'s Strategies for Office Planning, thinks not. At IDC's 1982 Information Processing Industry Briefing Session, Willmott described the introduction of the microcomputer into the office as hindering information management and upsetting the traditional role of data processing professionals. Management professionals want to take advantage of the processing power of micros, but lack the technical background to do so. As a result, pressure is put on the data processing department to fill this information gap.

DPers find that they not only have to provide the technical know-how to maintain and support conventional large-scale data processing equipment; they now have to provide support for a whole range of new systems, including microcomputers.

So we're at a position where microcomputer technology exists to make versatile computing power available to applications-oriented individuals, but we're at an impasse in transferring that technology to the human operator so it can be used to its full advantage.

A parallel exists between this situation and the personal use of microcomputers. Here, too, the technology exists, but the use of that technology is often hindered by a lack of knowledge.

It's impossible to foretell how the problem of technology transfer will be resolved. Already we have made enormous progress; witness the interest recently generated by the West Coast Computer Faire, the spring Comdex show, and this month's National Computer Conference.

The solution to technology transfer is probably more complex than any of us realize right now, but it might start with user's groups, more conscientious manufacturer support, or magazines like *80 Micro*. ■

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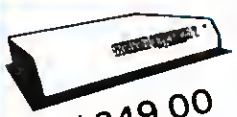

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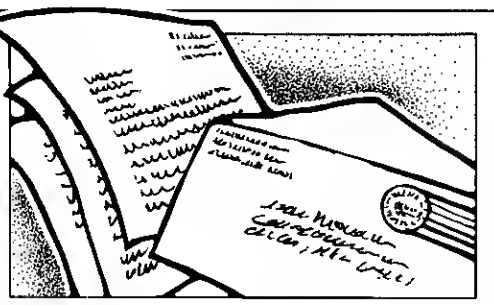

Bar Code Fever

I'd like to see a bar code reader series including:

- A hardware project to adapt the HP-wand reader to the TRS-80 or to build one from scratch.
- Software to support the reader.
- Software and printer specifications to print data or programs in a bar code format.

It would generate great interest if you printed bar code versions of the programs published in the same issue of *80 Micro.*

Eric A. Ziercher
155 Harford Road
Dryden, NY 13053

Anyone out there doing any work with bar code readers?—Eds.

For LNW Users

While more programs are becoming available for the LNW-80 all the time, support for LNW's special features is still lacking. One additional source of LNW-80 technical and programming information is available through our user's group's bimonthly newsletter.

Subscriptions to the newsletter are $12 per year. You can contact the user's group at the address below.

Jay J. Hokanson
The LNW USER Newsletter
4345 Manchester Road
Grand Island, NE 68801

Tandy Reliability

We like Tandy equipment. Our company uses a Model 16, and we have found it to be most reliable. Our machine has not had one microsecond of down time in over six months of heavy use. This reliability is a plus in the Model 16's favor that you constantly overlook when you take potshots at Tandy.

Your articles, information, and editorials about Tandy are one-sidedly pejorative. This would be understandable if your differences with that organization were all well-founded; however, not all of them are.

Tandy has been most supportive of our needs. With regard to program and operating-system updates, software help, and hardware changes, they have done more than any other company to treat us as a valued customer.

I agree that large corporations should be prodded when they display a lack of awareness over product problems. In our experience, Tandy does not fall into this category. On the contrary, we find that they do not neglect their obligations.

I have yet to find better machines than the Model 16 or Daisy Wheel II, a better word processor than Scripsit, or a better customer-service setup than the numbers in Fort Worth! We have product reliability, excellent software, and good technical support.

Such factors are not indicative of a corporation bereft of ethics, as you infer in several articles in the February issue.

John J. Esak
Nexus Inc.
50 Chuckanutt Drive
Oakland, NJ 07436

Supporting Software

I agree that piracy can be a problem for software producers and distributors. I've written rather complex programs myself, and am aware of the tremendous effort involved in writing and debugging them. With more complex and therefore more expensive programs, the improvement process should never stop.

Herein lies the best software protection available: continuing development, enhancements, and debugging. With these available only to registered owners, the pirate will soon be left behind.

Indeed, the software artist who markets a program of any complexity at more than a nominal price and doesn't provide continuing support deserves to get clobbered. He has abandoned his product in the marketplace. I don't contend that continuing support should be free, but it must occur.

I have a number of programs that are pirated, but anything I'm serious about I buy because I want on-going support. Before I'll buy a program, I usually start with a pirated copy to see how it performs.

Please don't misunderstand me. I am neither supporting nor advocating piracy. I am seeking a way for the customer to determine if software is suitable before, rather than after, a purchase. A 15-minute demonstration and pep talk by a salesman won't do.

The two DOSes I haven't paid for went through anywhere from several days to nearly three weeks of shakedowns before they proved unreliable with my software.

I'm hoping that out of this dilemma will emerge something to protect not only the rights of the software producers and distributors, but the rights of the purchasers as well.

Richard Torgerson
17 Surrey Lane
Decatur, IL 62526

AND/OR?

In the February 1983 Input (p. 22), William T. Faulkner points out that the XOR function can be emulated in Basic by ANDing two input values with each other's inverse and then ORing their results. This is correct, but I have been using a simpler approach.

When you perform an XOR, you OR the two values and then drop those bits that are set during an AND of the original values. Mr. Faulkner's C=(A AND (NOT B)) OR ((NOT A) AND B) can be shortened to C=(A OR B)−(A AND B).

David R. Goben
Lecoma Star Rt. Box 30
Rolla, MO 65401

The Key to Disk Basic

The following modifications to Don Rigg's "Autokey" (*80 Micro*, December 1982, p. 280) allow you to use the program under Model III Disk Basic.

First, delete lines 100–440 of the Assembly listing and enter Program Listing 1. On line 870, replace the Return command with a Jump com-

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* As compared to MTC AIDS-III, Version 1.0

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mand to 59C8H for TRSDOS, 5F79H for NEWDOS, or 02B8H for LDOS. Insert Program Listing 2 between lines 1120 and 1130.

Mr. Rigg used lines 2790–2810 to custom-design an additional one-key command linked to the Z key. To retain this feature, change line 2790 to read: DEFM '2FORI=1TOLEN(Z$) :POKEI+&Hnnnn. In place of the nnnn, use the memory address at which line 2780 assembled.

I also deleted the auto-start routine in lines 2860–2910 because I no longer use a cassette.

Now that you have changed the program, give it the file name DISKEY/CMD and enter the Basic program in Program Listing 3, using the file name DISKEY/BAS. To run DISKEY/CMD in Basic, type RUN"DISKEY/BAS". Line 20 will require changes under operating systems other than Model III TRSDOS.

Jack Blum
Rt. 1 Box 1025
Orland, CA 95963

Mr. Rigg's article also contained a Basic version of Autokey. This letter does not modify the program to work with disks.—Eds.

Colorful West Virginia

We have now formed a TRS-80 Color Computer User's Group in the Morgantown-Fairmont West Virginia area. For more information, contact me at the address below or call 304-599-4493.

Donald G. Barber, Jr.
P.O. Box 295
Granville, WV 26534

LPVIII Graphics

Many of you would probably like to have your LPVIII print graphics as they appear on the screen. The subroutine in Program Listing 4 will do just that.

The LPRINT statement in line 1000 initializes the printer. You can change the CHR$(number) in line 1030 to any of the graphic code numbers, from 225–255. The CHR$(128) in line 1030 prints the required blank spaces.

Jim Hanson
39723 Aub-Enum Hwy.
Auburn, WA 98002

```
00100          ORG          41E2H
00110          JP           START          ;Jump to AUTOKEY
00120          ORG          0FCE0H         ;for 32K use 0BCE0H
00130 START    LD           A,0C9H
00140          LD           (41E2H),A
```

Program Listing 1

```
01121          CP           10             ;Skip down arrow
01122          RET          Z
```

Program Listing 2

```
10 CLS
20 CMD"L", "DISKEY/CMD"
30 DEFUSR0=&HFCE0 'BCE0 for 32K
40 PRINT "DISKEY IS NOW RUNNING"
50 X=USR(0)
```

Program Listing 3

LNW Bulletin Boards

Two bulletin boards are operational in support of the LNW-80, one at 504-291-4331 and one at 516-924-8115. These bulletin boards contain a listing in download of little-known but important engineering change notices from LNW Research. The service also contains information on new, exciting, and inexpensive graphics software.

With the gradual disappearance of the Model I, I consider the LNW-80 the new frontier with abilities yet to be explored.

Larry Davidson
P.O. Box 592
Bothell, WA 98011

Printing Labels

Since the publication of "Making Labels" (*80 Micro*, Anniversary Issue 1983, p. 240), I have changed several lines of the program to simplify adaptation for printers other than the Heath H-14.

First, delete line 835. Then change line 240 and add line 245 as shown below:

```
240  A$=INKEY$:IFA$=""THEN 240
     ELSE IF A$=CHR$(8)PRINT
     A$;:GOSUB 2000 :IFBS<1GOTO220
     ELSE GOTO240
245  IFA$<>CHR$(13)THEN
     T$(J)=T$(J)+A$:IF LEN (T$(J))>ML
     THEN T$(J)="":GOTO220 ELSE
     PRINT A$;:GOTO240
```

If your printer is not a Heath H-14, modify line 840 to: LPRINT T$(J) and change line 780 to: LPRINT"TEST LINE";J.

Lines 710–750 are specific to the Heath printer in that they set type size and lines per inch; you can delete or change them if you use a different printer.

The statement OUT 251,n is the same as LPRINT CHR$(n) and is valid only for the Model III. Model I users must change all OUT 251,n statements as above.

One minor error appears in the original listing. Line 600 (for cassette users) should read T=INP(240):IF T=255 GOTO 1500.

William A. Nelson
1354 Hackett St.
Beloit, WI 53511

```
1000 LPRINT CHR$(18);CHR$(10);CHR$(27);CHR$(14);
1010 FOR H = 0 TO 47
1020 FOR W = 0 TO 127
1030 IF POINT(W,H) THEN LPRINT CHR$(255);ELSE LPRINT CHR$(128);
1040 NEXT W
1050 LPRINT ""
1060 NEXT H
```

Program Listing 4

REAR GUARD

Deadly waves of enemy Cyborg craft attack your fleet from the rear. You are the Mothership's sole defender. You have unlimited firepower but the Cyborgs are swift, nimble attackers. Your abilities are tested hard in this game or lightening fast action and lively sound from Adventure International. Price: B

STRIKE FORCE

As the primary defender of a world of cities under deadly alien attack, your weaponry is the latest: rapid fire missiles, long range radar and incendiary star shells. Your force field can absorb only a limited number of impacts. A complex game of strategy, skill and reflexes from Melbourne House. Price: A

NEW!

PANIK

Trapped at an enemy building site, your fate seems certain. Your laser is empty and evil Mizors are closing in. You'll have to climb ladders and think one step ahead of the various monsters. A challenging game for agile minds. From Fantastic Software with voice (Disk has larger vocabulary). Price: B

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Your submarine, the U.S.S. Sea Dragon, penetrates a mined enemy channel. Armed with missiles and torpedos, you engage the enemy while navigating unknown waters. Succeed or come to a salty end in this game. 29 screens of horizontally scrolling sea-scape and sound from Adventure International. Price: B

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5. CATERPILLAR - *Good rendition*
6. CRAZY PAINTER - *Unique game concept*
7. DEFENSE COMMAND - *Tough struggle*
8. STELLAR ESCORT - *Fast and Challenging*
9. ROBOT ATTACK - *With voice*
10. SEA DRAGON - *Amazing "Seascape"*

STELLAR ESCORT

The latest super action game from Big Five. As the Federation's top space fighter you've been chosen to escort what is possibly the most important shipment in Federation history. The enemy will send many squadrons of their best fighters to intercept. With sound. Disk version has voices. Price: A

ROBOT ATTACK

Talks without a voice synthesizer through the cassette port. With just a hand laser in a remote space station you encounter armed robots. Some march towards you, more wait around corners. Careful: the walls are electrified. Zap as many robots as you dare before escaping to a new section. More robots await you. Price: A

LUNAR LANDER

As a vast panoramic moonscape scrolls by, select one of many landing sights. The more perilous the spot, the more points scored -- if you land safely. You control LEM main engines and side thrusters. One of the best uses of TRS-80 graphics we have ever seen. From Adventure International. With sound. Price: A

SUPER NOVA

Asteroids float ominously around the screen. You must destroy the asteroids before they destroy you! (Big asteroids break into little ones). Your ship will respond to thrust, rotate, hyperspace and fire. Watch out for that saucer with the laser! As reviewed in May 1981 Byte Magazine. Price: A

NEW!

OUTHOUSE

You are the mighty protector of this small (but important) wooden structure. For reasons unknown, a bizarre gang of miscreants wish to vandalize, loot and otherwise destroy the little half moon house. Your patrol craft has lasers and smart bombs to deal with this terror. From SSM with sound. Price: A

GALAXY INVASION

The sound of the klaxon is calling you! Invaders have been spotted warping toward Earth. You shift right and left as you fire your lasers. A few break formation and fly straight at you! You place your finger on the fire button knowing that this shot must connect! With sound effects! Price: A

LASER DEFENSE

In this game of ICBM's, high-energy lasers and particle beams, you control the U.S. strategic defense satellite system. From your viewpoint high above the globe you intercept Soviet nuclear missiles in flight and attempt to destroy their scattered missile silos. With sound from MED Systems. Price: B

NEW!

CHICKEN

Will the chicken cross the road? That's up to you. Can you guide these helpless little chicks across the perilous 10 lane super highway to safety? Or will you bumble littering the blacktop with a storm of chicken feathers? A humourous yet challenging game of nerves from SSM with sound. Price: A

PENETRATOR

Soar swiftly over jagged landscape swooping high and low to avoid obstacles and enemy missiles attacks. With miles of wild terrain and tunnels to penetrate you're well armed with bombs and multiple forward missile capability. From Melbourne House. Features sound, trainer mode and customizing program. Price: C

NEW!

DEFENSE COMMAND

The invaders are back! Alone, you defend the all important nuclear fuel canisters from the repeated attacks of thieving aliens, repeatedly. An alien passes your guard, snatches a canister and flys straight off. Quick! You have one last chance to blast him from the sky! With sound and voice. Price: A

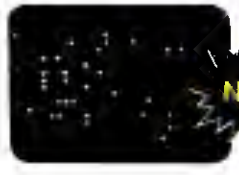
BEST SELLER

BOUNCEOIDS

Huge boulders careen off the walls. You're in the middle in danger of being flattened. Keep your wits about you as you blast these "bounceoids" from the screen. Large ones break into many small ones. Clear a screen, and enter a fast-paced challenge stage with a chance for big bonus points. From the Coinsoft Group. Price: A

SCARFMAN

This incredibly popular game craze now runs on your TRS-80! It's eat or be eaten. You run Scarfman around the maze, gobbling up everything in your path. Try to eat it all before nasty monsters devour you. Excellent high speed machine language action game from the Coinsoft Group. With sound. Price: A



ARMORED PATROL

A realistic tank battle simulation. Your view is a 3-D perspective of an alien landscape. Maneuver your T-36 tank to locate and destroy enemy tanks and robots that lay hidden, ready to assault you. Clever graphics create the illusion of movement and dimension. From Adventure International. With sound. Price: B

CATERPILLAR

An arcade favorite! Stop these multi-sectioned crawlers before they creep down through the mushrooms. Zap one and it splits into two smaller bugs, each with its own sense of direction. There are moths and tumble bugs too. It all adds up to lots of fun for kids and adults alike. From Soft Sector Marketing. With sound. Price code: A

NEW!

CRAZY PAINTER

You have to paint the floor white. We give you the paint and brush. Sounds easy? Hah! You'll be confounded by stray dogs, snakes, sloshing buckets of turpentine, even a ravenous "paint eater". A crazy, imaginative new game with ten selectable levels of skill for new or seasoned game players. Lots of laughs. Price: A

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```
 110          ORG     32533          ;(LOAD ADDRESS)
 111 MSIZ     LD      HL,32530       ;LOAD MEM SIZE
 112          LD      (40B1H),HL     ;TOP OF MEMORY POINTER
 113          LD      DE,0FECEH      ;CALCULATE DISPLACEMENT
 114          ADD     HL,DE          ;FOR VARIABLE POINTER
 115          LD      (40A0H),HL     ;SAVE IT
 116          CALL    1B72H          ;SET ALL PTRS & RETURN
 117          LD      HL,32565       ;LOAD ENTRY ADDRESS
 118          LD      (4174H),HL     ;POINT CMD TO ENTRY POINT
 119          LD      DE,0FECEH      ;CALCULATE DISPLACEMENT
 120          ADD     HL,DE          ;FOR VARIABLE POINTER
 121          LD      (40A0H),HL     ;SAVE IT
 122          CALL    1B72H          ;SET ALL PTRS & RETURN
 125 CMDIN    PUSH    HL             ;SAVE ORIGINAL HL
 300 EXIT     JP      301            ;(JUMP L3 ERROR)
1100 LNINT    RET                    ;INSERT 41C4H INSTRUCTION
1105          RST     38H            ;INSERT 41C5H INSTRUCTION
1106          NOP                    ;INSERT 41C6H INSTRUCTION
1180          END     MSIZ           ;SET UP FOR /(ENTER) ACTIVATE
```

Program Listing 5

Cassette BASTEP

"BASTEP" by Alan D. Smith (*80 Micro*, January 1983, p. 352) is excellent for debugging Basic programs. To use the Assembly-language version for a 16K cassette system, renumber line 120 as 125 to make room for new lines. Then make the changes and additions in Program Listing 5.

BASTEP is now located at the top of 16K memory and can be relocated by changing the addresses in statements 110, 111, and 117 by equal displacement.

By adding 16384 to each address, you place the program at the top of 32K memory. This allows placement below any other Assembly-language programs that might be stored in memory.

This program also runs on the Model III. Ignore the syntax error that appears after loading the program.

Robert A. Hood
8218 Tracyton Blvd. NW
Bremerton, WA 98310

Model 16 Update

While I like seeing coverage of the Model 16, Jim Hawkes' article, "The Model 16" (*80 Micro*, February 1983, p. 228), has several problems.

The 68020 has 32 data lines, but only 24 address lines. The 68032 will have 32 address lines.

Since I've used a set of stand-alone, 8-inch drives for some time, I believe I am inserting disks in my Model 16 right side up: label at the top outer corner and facing me. The Model II is upside down.

Only the run-time environment of the multi-user operating system will be free. This lets you run turnkey application packages. The development package will include a full C compiler and cost about $700. It is Xenix, Microsoft's licensed UNIX with extensions. Tandy is not writing their own 16-bit operating system.

Radio Shack has announced that they will sell and support CP/M 3.0, also called CP/M Plus, for the Models II, 12, and 16. This version supports bank-switched RAM for the Z80.

They have not announced support of CP/M-68K, the Digital Research operating system for the 68000 CPU. CP/M-68K is written in C and should be available from a third party.

I have not found a way to emulate four single-sided drives on my two double-sided ones, under either TRSDOS or CP/M.

Multi-user Cobol, as well as Fortran and an expanded-address Basic, will be added to C as Microsoft brings them up. High-level languages will be plentiful under Xenix.

UCSD Pascal and the rest of the p-System Version IV (Fortran, Basic, Lisp) are already up and running on the 68000 in a Model 16.

At this time, I don't know if the expanded card cage in the Model 12 (six

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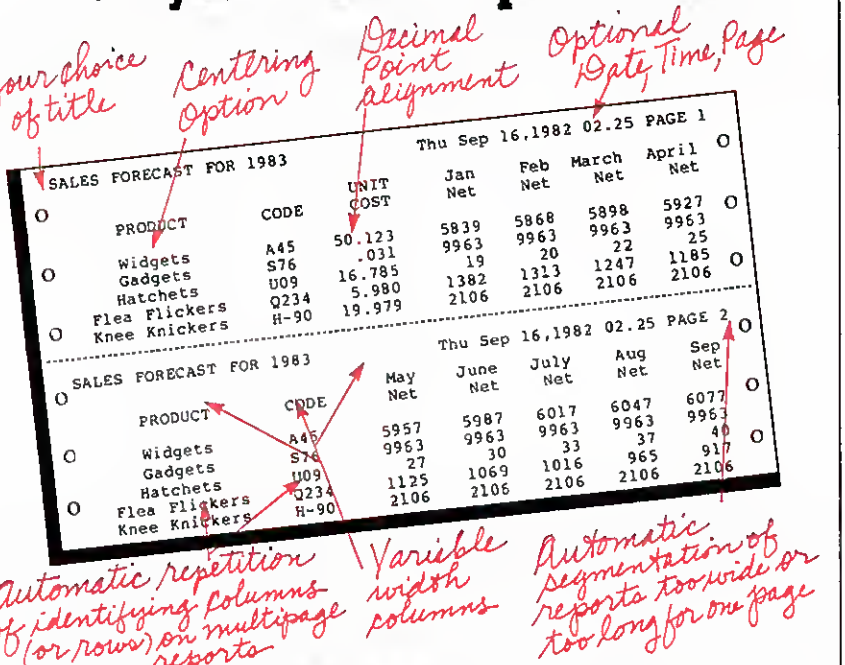

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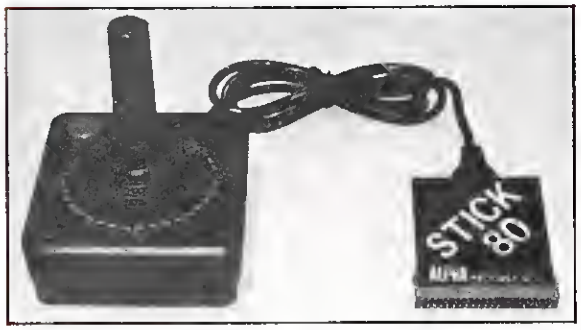

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slots) will fit the Model 16, or be an external option.

Incidentally, the Model 12 cage is accessible to the user through a two-thumbscrew panel in the back that is not sealed. Also, the new keyboard should fit the old II/16 units with a female/female adaptor. The new keyboard has the cable attached, whereas the old had a socket for the cable from the cabinet.

At last we have nonproprietary operating systems and user access.

Mark P. Fishman
51 Grandview Road
Arlington, MA 02174

Hawkes Replies

I agree that the phrase "true 32-bit device" is a bit strong as applied to the MC68020. However, I believe that the 68020 would be considered by most as a 32-bit CPU despite having only 16 megabytes of addressable memory.

Second, I think that most 80 Micro *readers would agree with my statement regarding the insertion of the Model 16 disks.*

Also, the article specifically stated that the "CORE" system would be free.

Finally, this article was written in September 1982, and at that time little real software was available to report.

Jim Hawkes
The College of Charleston
Charleston, SC 29424

Error Trap

The Color Key (*80 Micro*, March 1983, p. 34) gave the wrong address for Nelson Software. The corrected version is as follows: 9072 Lyndale Ave. S., Minneapolis, MN 55420, 612-881-2777. For orders only, call 800-328-2737.—Eds.

Color Save

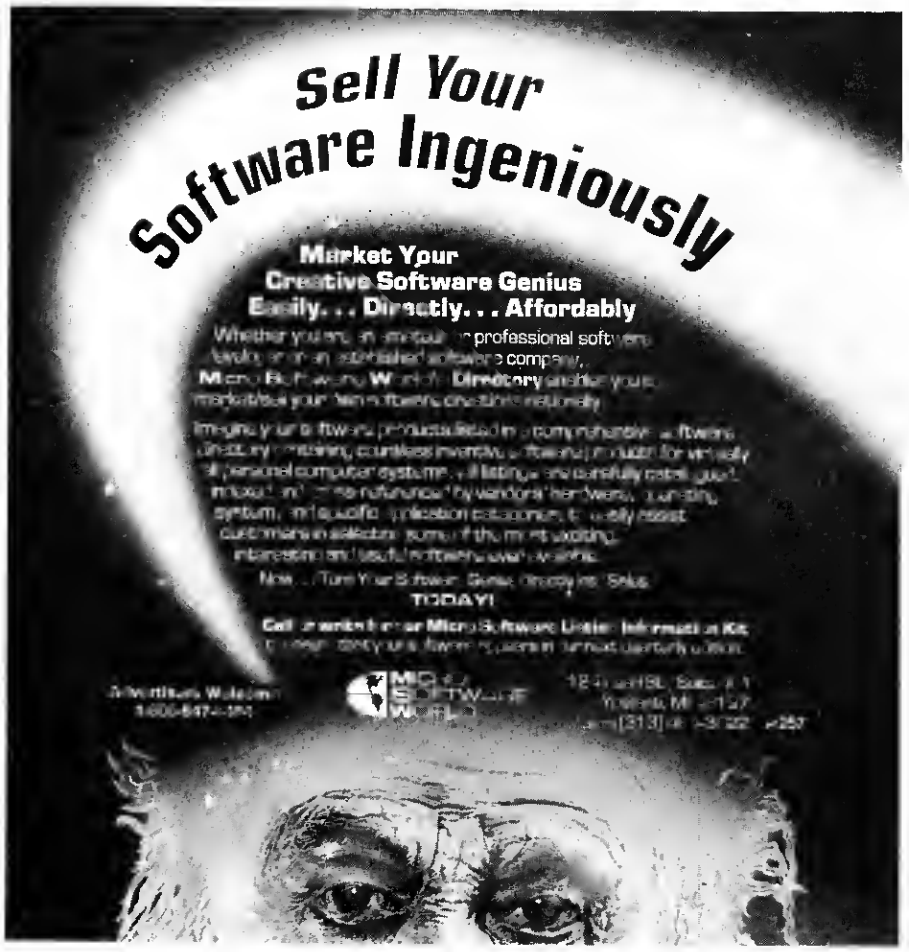
In Feedback Loop (*80 Micro*, March 1983, p. 414), Terry Kepner recommends buying a copying utility to CSAVEM a machine-language program on the Color Computer. It is much easier to enter the following commands from the keyboard after you load the program.

```
<?PEEK(487)*256+PEEK(488)>
<?PEEK(126)*256+PEEK(127)-1>
<?PEEK(157)*256+PEEK(158)>
```

These commands give you the starting address, ending address, and execute address, respectively. Then CSAVEM "Filename", starting address, ending address, execute address.

This method only works with non-auto-execute machine-language programs and it does not work well with a disk system.

Donald G. Barber, Jr.
P.O. Box 295
Granville, WV 26534



Model II News

As you are aware, there are many more Model I and Model III systems than there are Model IIs.

However, help is on the way for Model II users, as we have just formed a national Model II user's group. We plan to publish a user directory and a short newsletter. Anyone interested in finding out more about our group should send us a stamped, self-addressed envelope.

Bob Stewart
National TRS-80 Model II
User's Group
P.O. Box 234
Ada, MI 49301

Attn: Cincinnati

The Cincinnati TRS-80 User's Group (CINTUG) has been in existence for over three years. We meet on the second Saturday of each month. You can access our bulletin board at 513-791-8208. Send written queries to the address below.

Carolyn Wiedamann
Vice President
CINTUG
P.O. Box 9145
Cincinnati, OH 45233

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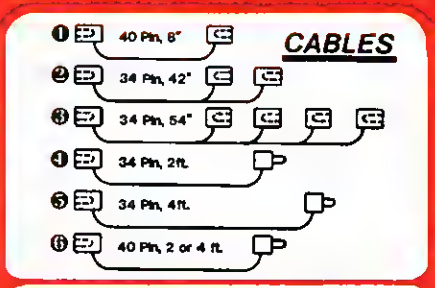

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GREEN SCREEN WARNING

IBM and all the "biggies" are using green screen monitors. Its advantages are now widely advertised. We feel that every TRS-80 user should enjoy the benefits it provides. But **WARNING:** all Green Screens are not created equal. Here is what we found:

- •Several are just a flat piece of standard colored Lucite. The green tint was not made for this purpose and is judged by many to be too dark. Increasing the brightness control will result in a fuzzy display.
- •Some are simply a piece of thin plastic film taped onto a cardboard frame. The color is satisfactory but the wobbly film gives it a poor appearance.
- •One "optical filter" is in fact plain acrylic sheeting.
- •False claim: A few pretend to "reduce glare". In fact, their flat and shiny surfaces (both film and Lucite type) ADD their own reflections to the screen.
- •A few laughs: One ad claims to "reduce screen contrast". Sorry gentleman but it's just the opposite. One of the Green Screen's major benefits is to increase the contrast between the text and the background.
- •Drawbacks: Most are using adhesive strips to fasten their screen to the monitor. This method makes it awkward to remove for necessary periodical cleaning. All (except ours) are flat. Light pens will not work reliably because of the big gap between the screen and the tube.

Many companies have been manufacturing video filters for years. We are not the first (some think they are), but we have done our homework and we think we manufacture the best Green Screen. Here is why:

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- •The filter material that we use is just right, not too dark nor too light. The result is a really eye pleasing display.

We are so sure that you will never take your Green screen off that we offer an unconditional money-back guaranty. Try our Green Screen for 14 days. If for any reason you are not delighted with it, return it for a prompt refund.

A last word. We think that companies, like ours, who are selling mainly by mail should •list their street address•have a phone number (for questions and orders)•accept CODs, not every one likes to send checks to a PO box•offer the convenience of charging their purchase to major credit cards. How come we are the only green screen people doing it?

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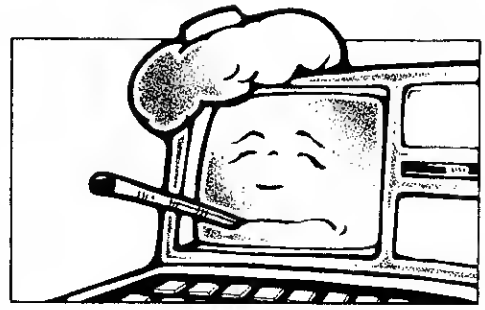

Looking for help

Scarce as Hen's Teeth

Usable programs for the 4K TRS-80 Color Computer are as scarce as hen's teeth. I'd appreciate hearing from anyone who knows where I can find good business and game programs.

Charles W. Gordon
17B Byron Court
Greenville, SC 29605

Wanted: Hot Programs

Our volunteer fire company is looking for Model I/III programs to use in planning our fire presuppression policy. Any help is appreciated.

John M. Howey Jr.
538 Walnut St.
Freeland, PA 18224

Interface Problems

I haven't been able to find an interface or a driver program to let me use my Model 33 Teletype with a TRS-80 Model III. Can someone help me?

D.A. Kitchen
Box 176
Bushell Park, Saskatchewan
Canada S0H 0N0

Making the Model I Read

Does anyone know how I can program my Model III to write single-density files that can be read by a Model I?

David H. Hall
149 Runnymede Road
West Caldwell, NJ 07006

Making Mountains

I'd like to know more about a mathematical function used to change a flat plane into a fractal surface. In 3-D computer images it is used to make mountains. If you know anything about this function please write to me.

Carlos Borgarth da Silva
Rua Guilherme Marconi 80
Apt. s504
Rio de Janeiro, Brasil
RJ CEP 20.240

Any Suggestions?

I'm using the Epson MX-80 to print my club newsletter, but I can't get it to reverse line feed to the top of the column and it's difficult to align the manual setting. Professional word processors can format in multiple columns, but Scripsit isn't up to it. Any suggestions?

Derek Trayler
88 Grosvenor Drive
Hornchurch, Essex
England RM11 1PW

I Need a Patch!

I'm unable to use SuperScripsit with double density on my Model I. I hate to go to single density with a long manuscript. Does anyone have a patch that will let me use SuperScripsit with double density?

Alice Fuchs
10 Evergreen Drive
Lock Haven, PA 17745

Needs Labels

I'd like to catalog my collection of video cassettes with a data base. My problem is that I can't find a company offering labels on continuous forms that are the size I need. Can anyone help me?

Brad Corson
c/o Jet Cargo International
P.O. Box 520010
Miami, FL 33152

Foreign Letters

I own a Model III with a normal keyboard. I'd like to program and print in Turkish. Does anyone know how I can print letters that aren't used in any European language? If so, what kind of printer will I need?

Eren S. Inonu
111-15, 75 Ave. #2M
Forest Hills, NY 11375

Needs Address Change

How do I change the address of the Auto-Dial/Answer device found on p. 300 in the 1983 Anniversary Issue to a port other than 254? My LNW-80 uses port 254 for hi-res graphics.

Barry Bea
61 Hallow Crescent
Rexdale, Ontario
Canada M9W 2V8

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Deanie C. Gross
Executive Director
National Multiple Sclerosis Society
301 South Broad St.
New Orleans, LA 70119

Hi-Res Patches

I own a Model III with the new RS high-resolution graphics, a HIPAD digitizer, and a DMP-29 HIPLOT plotter. I'm interested in any software that ties all these components into a graphics design and CAD system.

I'm also interested in patches and drivers that bring out high-resolution graphics with Radio Shack's Business Analysis Graphics Pak.

Doug Landmann
273 Willow Drive
Hartland, WI 53029

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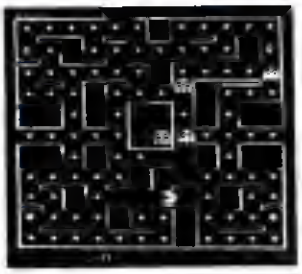


GHOST GOBBLER

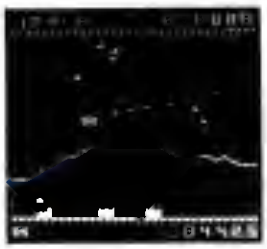
From Spectral Associates, this "Pac" theme game is the best of it's type. Brilliant color, action and sound, just like an arcade gobble your way to glory, but watch for those ghosts! Get in on the wild fun of this game craze now. Tape: $21.95, Disk: $25.95

GHOST GOBBLER

DONKEY KING

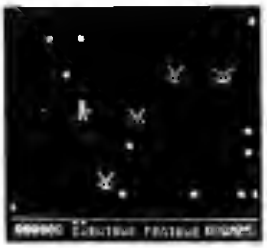
DONKEY KING

You simply can not buy a more impressive game for your color computer than this new wonder from Tom Mix. The graphics, sound, and animation are all just astonishing! There are four different graphic screens and each is endless fun. Requires 32K. Tape: $24.95, Disk: $27.95



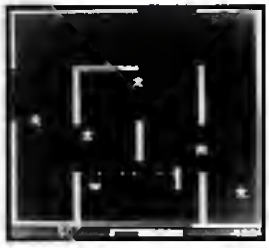
PROTECTORS

There are several good versions of the "Defender" theme available for the CoCo. None, however, rival this one from Tom Mix. No other game matches the detailed graphics and sheer excitement of this top seller. Requires 32K. Tape: $24.95, Disk: $27.95



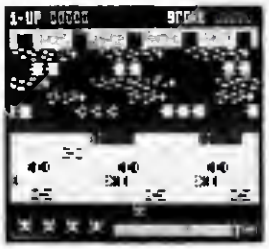
CREATURE FEATURE

From Color Software, comes a lightening swift shoot & dodge the enemy game. It's clever cross between "Robotron" and "Beserk" themes, with bullets flying everywhere. Solid, shoot-em-up-fun. Requires 16K. Tape: $17.95. Disk: $19.95



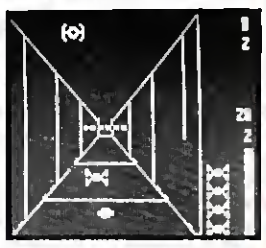
ANDROID ATTACK

Spectral Associates' very well done "Berserk" type game with some interesting added features. Each cassette contains both the 16K and 32K version. The 32K version has voice output! Plenty of action. Tape: $21.95



FROGGER

Just released by The Cornsoft Group, this is the officially licensed version from Sega, the arcade manufacturer. It has it all! 4 lane super highway, snakes, turtles, logs, alligators, etc. Lots of action and laughs! Requires 16K. Tape: $19.95



INTERGALACTIC FORCE

Your space fighter roars into the Death Corridor. Lock-on and blast the enemy fighter from the sky. Now try dropping one into Death Star's narrow exhaust vent. It takes skill and guts. Good luck! With "Star Wars" theme song. From Anteco Tape: $24.95

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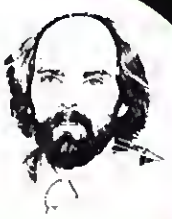

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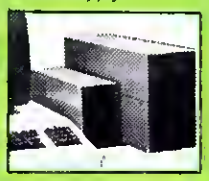

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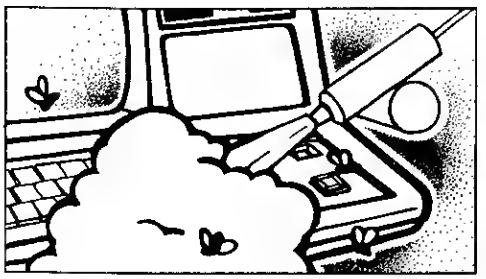
Found and Fixed

I found and fixed some bugs in my "Outbreak" program (January 1983, p. 216). Most of the problems come from the sound routine, but a bug lives in line 200. To exterminate this problem enter it as: 200 IF X>126 THEN A=−A:X=126:GOTO 170.

If you own a tape system and are having problems with the sound routine, change Z1=127 to Z1=126 in line 700, or set the memory size to 32000. The sound is improved by changing all the USR(12)'s to USR(0)'s.

If you own a disk system and are having sound routine problems, you should change line 700 to: 700 DEFUSR0=32000: Z=32000. You should also change all JJ=USR(12)'s to JJ=USR(0)'s.

Tom Hanson
2120 Birchmont Drive
Bemidji, MN 56601



Patches and fixes

Our Fault

The following program (see Listing 1) was left out of Steven M. Groll's "The 2,000-Year-Old Algorithm" article (March 1983, p. 332). The line numbers mentioned in the first column on p. 333 refer to this program listing.—*Eds.*

Program Listing 1

```
9000 GOSUB9990
9010 PRINT"HOW MANY NUMBERS TO BE INPUT?"
9015 INPUT"(10 OR LESS)";F
9020 IFF>10 THEN 9000
9030 PRINT:PRINT"*NUMBERS MUST BE INPUT IN"
9040 PRINT"ORDER FROM SMALLEST TO LARGEST *"
9042 PRINT"*ALL NUMBERS MUST BE SMALLER"
9043 PRINT"THAN 1,000,000*"
9045 FORG=1TOF
9050 PRINT:PRINT"INPUT #";G;":";
9060 INPUTM(G)
9065 IFM(G)>999999THEN 9000
9070 IFG>=2THEN 9100      'YOU NEED AT LEAST 2 TO COMPARE
9080 NEXT
9090 GOTO9190
9100 IFM(G)>M(G-1)THEN 9080      'MAKE SURE NUMBERS IN ORDER
9110 GOSUB9990:PRINT"THE NUMBERS MUST BE INPUT IN"
9120 PRINT"ORDER FROM SMALLEST TO LARGEST"
9130 FORX=1TO 2000:NEXT:GOSUB9990
9140 GOTO9045
9190 CLS
9200 FORG=1TOF-1
9210 Q=INT(M(G+1)/M(G))          'Q=QUOTIENT
9220 R=M(G+1)-(M(G)*Q)           'R=REMAINDER
9230 IFR=0THEN 9300
9240 M(G+1)=M(G):M(G)=R       'REASSIGN VALUES
9260 GOTO9210
9300 IFG=F-1THEN 9400        'LAST ONE?
9305 M(G+1)=M(G)     'OLD DIVISOR BECOMES NEW DIVIDEND
9310 NEXT
9400 GOSUB9990:PRINT"GCD = ";M(G)
9500 PRINT:PRINT:PRINT:PRINT"DO YOU WISH TO CONTINUE?"
9505 PRINT"Y=YES  N=NO)"
9510 INPUTA$:IFA$="Y"THEN9000ELSEEND
9990 CLS:PRINTCHR$(23):RETURN
10050 ' ----------------------
10060 '   EUCLIDEAN ALGORITHM
10070 '   COMPLETED   5/19/81
10080 '     STEVEN M. GROLL
```

The Judge's Decision

Figure 1 in my "Judge 80" article (January 1983, p. 221) is incorrect. The correct pinouts to IC4 are, from top to bottom:

IN	OUT
3	4
1	2
13	12
5	6
11	10
9	8

Also, the correct identification for IC2 in the IC list is:

IC1,2	74LS367
IC3	74LS08
IC4	74LS04

Stuart A. Cole
Rt. 5, #1 Five Oaks Lane
Gulfport, MS 39503

Directory Patches

Although the code in Carl Anderson's "Easier Directory" (December 1982, p. 32) assembled with no errors, the program produces nondescript garbage. The problem is not with the code, but with TRSDOS 1.3. Radio Shack released TRSDOS 1.3 with several errors and then published patches for some of them in the October 1981 issue of *TRS-80 Microcomputer News*. The problem is found in the I/O call to display the directory. The following two patches correct this anomalous I/O call.

PATCH * 10 (ADD=4E2E, FIND=CD3E4B, CHG=CD8A50)
PATCH * 10 (ADD=508A, FIND=4469736B, CHG=4FC33E4B)

James A. Calloway
645 Tarreyton
Ruston, LA 71270

Better Music

The "Dual-Voice Music Synthesizer" by Lee Morgenstern (1983 Anniversary Issue, p. 253) bombs on the Model I with an OV error at line 1160. To correct this, change line 1160 to read: 1160 READ Q:POKE X−1+P,Q:NEXT and

change line 1030 to: 1030 CLS:CLEAR 500:DEFINT A-Z.

After doing this, insert line 1055 which reads: 1055 M$ = STRING$ (152,0). Line 1055 is exactly the same as line 1110, but don't delete line 1110. This changes the starting address of M$ to 32464 instead of 32616.

Paul F. Smith
305 S. Warmister Road
Hatboro, PA 19040

Fire One!

I found an error in David Edick's "Space Duel" program for the Model III (August 1982, p. 260). To let your spaceship fire, change line 123 to: IF A$ = "C" THEN 1000.

Mari Ascolese
115 Ave Maria
San Antonio, TX 78216

Sorting Problem O.K.

There's an error in Bill Barden's "Assembly-Language Primer" program listing (1983 Anniversary Issue, p. 16) that prevents the last element from being sorted. The eighth data element in line 101 of Program Listing 3 should be changed from 254 to 255.—*Eds.*

Turtle Problems

Larry Brackney's "TRS-Turtle" program (February 1983, p. 116) has a bug under its shell. To get rid of it, change line 250 to: 250 L$(W) = B:W = W + 1:T$ = B.—*Eds.*

It's an Arrow!

There's a typo in the correction to Delmer Hinrichs' "Practical Regression Analysis" program in the February 1983 Debug column (p. 30). In line 2830, between the DZ and 3 there should be an up-arrow instead of a parenthesis. Otherwise it is correct.

Oh, well. You know what they say: "...and these bugs have smaller bugs upon their backs to byte them...."—*Eds.*

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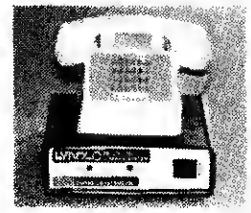

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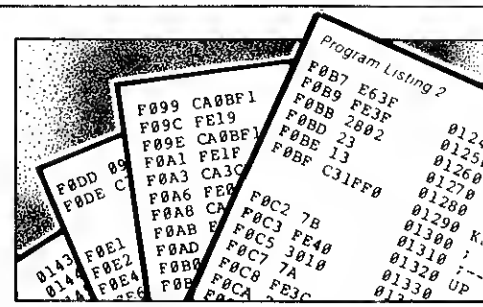

Changing the Basic language

This column is a little different from my previous offerings. Instead of discussing how to include machine-language routines in Basic programs, I will explain the ultimate Basic interface: how to change Basic itself. I hadn't planned to delve into this topic for several months, but the one change explained here makes a lot of other programming much simpler.

I have always been aggravated by the lack of a proper Restore command in Radio Shack's Basic. Restore should set the read pointer to any data table in a program. In a large program with data statements for subroutines as well as the main line of the program, you must often Restore to the beginning of the program and then include dummy, time-wasting reads until the correct data table is found. Saving and reloading the read pointer with PEEKs and POKEs helps only if the program reads the same data table more than once.

After examining ROM, I developed a modification meeting all my requirements. Restore works as it always did until a line number is added—then it works the way I want it to. My modification supports tape or disk systems and operates under all disk operating systems. The patch works so well I have added it to my copy of NEWDOS80 2.0.

I will explain how to add this Restore patch to your operating system. In future columns, I will feel free to include the patch in my programs.

Patching Basic

How do you alter Basic? Depending on what you want to do, the process is fairly simple. Several exits from ROM to low memory let you interrupt and expand the normal process of Level II Basic. Disk Basic uses most of these exits, so the biggest difficulty in adding more Basic features is identifying the appropriate exit.

The execution phase of every Basic command starts at ROM location 1D5AH, where the first machine instruction is an RST 10H. An RST, or restart, is a 1-byte call to a frequently-used subroutine instead of a normal 3-byte call sequence. When a restart is performed, the Z80 processor pushes the next address (1D5BH in this case) onto the stack and then passes control to the RST address.

The instruction at 0010H is JP 4003H. The normal instruction at 4003H is JP 1D78H. As Basic begins to execute each new instruction, control jumps from 1D5AH to 0010H to 4003H to 1D78H—a circuitous route to jump ahead 30 bytes in memory. Several other routines in Basic also use RST 10H to call the subroutine at 1D78H, which gets the next character from the current command line or line of Basic, does some simple testing, sets the status flags according to the value found, and returns control to the calling routine. RST 10H is probably used dozens of times each second a Basic program runs.

An important point to remember is that 4003H is in RAM. You can put a new address for the JP instruction there and patch in your own routine. As long as your patch knows which ROM routine called it, it interrupts that routine and adds new features to Basic. Because the stack points back to the original caller, your routine merely has to examine the first two values on the stack to know whether it should interrupt.

With that in mind, and with the help of other ROM routines, I wrote Program Listing 1. The heart of the program, lines 580–950, uses only 48 bytes of memory and is completely relocatable. The first part of the program, lines 350–530, is a short routine that finds the top of unprotected memory, places the main program there, protects it, and correctly patches the interpreter exit at 4004H.

LOAD 80

The main program works by testing the stack to see if RST 10H was called by the execution routine at 1D5BH. If that test fails, control is returned to normal interpreter flow in line 650; otherwise, you must make additional tests.

Lines 690–750 test to see if the next executable command is the token for the Restore verb. Again, if that test fails, control returns to normal program flow. When a Restore verb is found, lines 790–820 determine if it is followed by a numeric value. If not, the normal Restore routine is invoked. But when a numeric value does follow the verb, the final (and most important) part of the program is used.

Line 870 calls a ROM routine that translates the numeric value following the Restore verb into a line number and places the line number in the DE register pair. Then line 890 calls another ROM routine placing the address of the line in the HL register pair.

Finally, in line 910, the resulting address is placed in the read pointer at 40FFH—the objective all along. Then the stack and the HL buffer are tidied up and control passes back to the Basic interpreter as if nothing happened. The interpreter doesn't know it was interrupted by a new routine.

Using the New Restore

If you plan to use the new Restore with Disk Basic, you must first make one crucial test to be sure it works. Go to Disk Basic and run the following:

```
PRINT PEEK(&H4004); PEEK(&H4005)
```

If your computer does not respond with the values 120 and 129, your operating system is already patched into the RST 10H RAM exit. Use Debug to find the value stored in 4004H and 4005H (remember that the address is stored in least significant byte/most significant byte, LSB/MSB, order). Use that new value for the exit equate in line 290. The program documents other necessary changes.

Assemble Listing 1 as either a /CMD file or a system tape. Run the program and try the short test in Program Listing 2 (with a disk system, run Listing 1 before going to Disk Basic). If the

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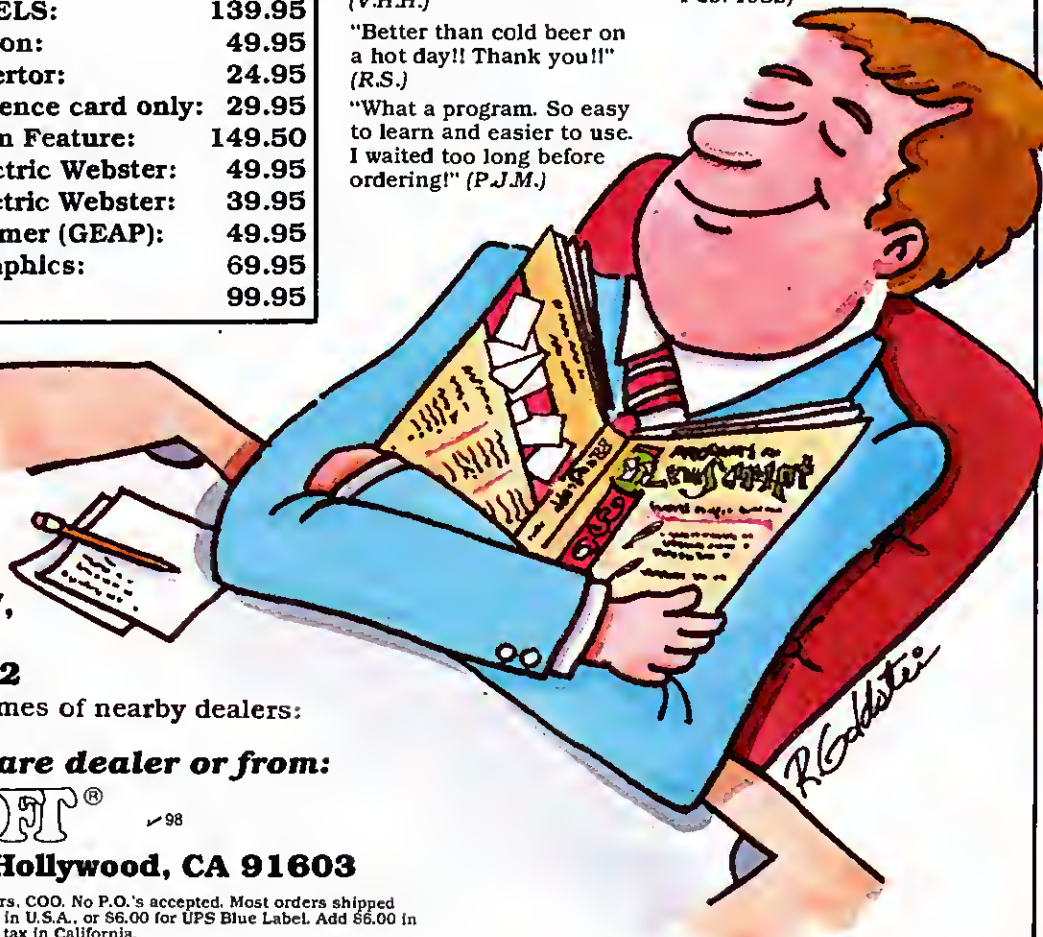

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```
                00100 ;****************************************
                00110 ;*                                      *
                00120 ;*       RESTORE/PATCH                  *
                00130 ;*                                      *
                00140 ;*  Adds, in both Level II and Disk     *
                00150 ;*  Basic, a variation of RESTORE       *
                00160 ;*  to allow the new syntax             *
                00170 ;*  RESTORE nnnnn to reset the READ     *
                00180 ;*  pointer to any line (nnnnn) in      *
                00190 ;*  the Basic program                   *
                00200 ;*                                      *
                00210 ;****************************************
                00220 ;
                00230 ;This version works as either a /CMD file
                00240 ;or a system tape
                00250 ;
1D78            00260 EXIT    EQU     1D78H           ;NORMAL RST10H JUMP
40A0            00270 STRING  EQU     40A0H           ;STRING AREA POINTER
4049            00280 HIMEM   EQU     4049H           ;TOP OF MEM POINTER
                00290 ;       This HIMEM value for Mod.I Disk
                00300 ;       Use 4411H for Mod.III Disk
                00310 ;       Use 40B1H for Level II
                00320 ;
7000            00330         ORG     7000H           ;WILL FIT 16K-48K
7000 2A4940     00340         LD      HL,(HIMEM)      ;GET CURRENT MEM. TOP
7003 013000     00350         LD      BC.30H          ;PROGRAM LENGTH
7006 AF         00360         XOR     A               ;RESET CARRY FLAG
7007 ED42       00370         SBC     HL,BC           ;PROGRAM DESTINATION
7009 E5         00380         PUSH    HL              ;TRANSFER IT TO
700A D1         00390         POP     DE              ;  DE REGISTER
700B 220440     00400         LD      (4004H),HL      ;PATCH RST10H VECTOR
700E 2B         00410         DEC     HL              ;DROP COUNT
700F 224940     00420         LD      (HIMEM).HL      ;SET NEW MEM. TOP
7012 C5         00430         PUSH    BC              ;SAVE PROGRAM LENGTH
7013 01CEFF     00440         LD      BC.-50          ;STRING SPACE
7016 09         00450         ADD     HL,BC           ;NEW STR. SPACE ADDR.
7017 22A040     00460         LD      (STRING),HL     ;CHANGE POINTER
701A C1         00470         POP     BC              ;GET BACK PRG. LENGTH
701B 212370     00480         LD      HL,START        ;HL==>BEG. OF MAIN PROG.
701E EDB0       00490         LDIR                    ;TRANSFER PROGRAM
7020 C32D40     00500         JP      402DH           ;RETURN TO DOS READY
                00510 ;               NOTE -- In Level II, use JP  06CCH
                00520 ;
                00530 ;***  MAIN PROGRAM -- This is the part that is saved
                00540 ;                     in protected high memory
                00550 ;
                00560 ;First, test if RST10H called by Basice execution driver
                00570 ;
7023 E3         00580 START   EX      (SP),HL         ;GET TOP OF STACK
7024 7D         00590         LD      A,L             ;GET LSB OF STACK VALUE
7025 FE5B       00600         CP      5BH             ;   AND TEST IT
7027 2003       00610         JR      NZ,NO           ;GO IF NOT 5BH
7029 7C         00620         LD      A,H             ;GET MSB OF STACK VALUE
702A FE1D       00630         CP      1DH             ;   AND TEST IT
702C E3         00640 NO      EX      (SP),HL         ;STACK & HL RESTORED
702D C2781D     00650         JP      NZ,EXIT         ;GO IF NOT CORRECT CALLER
                00660 ;
                00670 ;Now test for RESTORE token
                00680 ;
7030 CD781D     00690         CALL    1D78H           ;GET NEXT VALUE IN REG. A
7033 FE90       00700         CP      90H             ;RESTORE TOKEN?
7035 2804       00710         JR      Z,YES           ;GO IF TOKEN FOUND
7037 2B         00720         DEC     HL              ;ELSE CORRECT POINTER
7038 C3781D     00730         JP      EXIT            ;NOW LET BASIC WORK
                00740 ;
                00750 ;RESTORE token found -- now check for line
                00760 ;                     number following it
                00770 ;
703B CD781D     00780 YES     CALL    1D78H           ;IS NEXT VALUE NUMERIC?
703E 3803       00790         JR      C.YES2          ;GO IF IT IS
7040 C3911D     00800         JP      1D91H           ;ELSE TO NORMAL RESTORE
                00810 ;
                00820 ;RESTORE token followed by a numeral -- assume it is
                00830 ;       a line number, otherwise UNDEFINED LINE # error
                00840 ;
7043 CD5A1E     00850 YES2    CALL    1E5AH           ;GET LINE # IN DE
7046 E5         00860         PUSH    HL              ;SAVE POINTER
7047 CDC81E     00870         CALL    1EC8H           ;GET LINE ADDR. IN HL
704A 2B         00880         DEC     HL              ;GO BACK ONE SPACE
704B 22FF40     00890         LD      (40FFH).HL      ;PUT IT INTO READ POINTER
704E E1         00900         POP     HL              ;GET POINTER
704F 2B         00910         DEC     HL              ;CORRECT POINTER
7050 C3781D     00920         JP      EXIT            ;BACK TO BASIC EXEC.
7000            00930         END     7000H
00000 TOTAL ERRORS
```

Program Listing 1

screen fills with asterisks, everything is working perfectly. If you get an error message, or if any zeros appear on the screen, examine Listing 2 first, and then check Listing 1.

The syntax for the new Restore command is exactly what you expect. If you wish to read a block of data starting in line 400, enter RESTORE 400 or RESTORE400. RESTORE without a line number works as it always has, and you can use RESTORE followed by a line number anywhere the old RESTORE is used except as part of an If...Then statement. If...Then has its own syntax checks and reports RESTORE 400 as a syntax error. Also, if you use a renumbering utility, you'll probably find that it won't correct line numbers after RESTORE because it won't expect any. You will have to reset the line values yourself.

"If the screen fills with asterisks, everything is working perfectly."

Making It Permanent

If you find the Restore patch useful, make it a permanent part of your operating system and a standard part of Disk Basic. I've successfully included it in both NEWDOS80 2.0 for the Model I and TRSDOS 1.3 for the Model III; you can add it to other Disk Basics using the same techniques.

Be sure that you work with a scratch copy of your operating system, never with the original or your primary backup. Also, keep careful records of your work. You might want to change the patch next week or next year, and without those records you'll have trouble.

Your first job is to find room in Disk Basic and in memory to patch in the new code. Most operating system writers include patch space in their major programs to allow for future updates and corrections.

I will start with NEWDOS80 2.0. Figure 1a shows the Superzap dump of BASIC/CMD's relative sectors 14D and 15D (as they are on my original copy of NEWDOS80). Sector 15 is composed almost entirely of zero bytes—a strong indication that it is zap space. In order to test whether this space is useful for patches and zaps, you need to know where in memory it loads.

Load Basic and perform as many Disk Basic functions as you can, includ-

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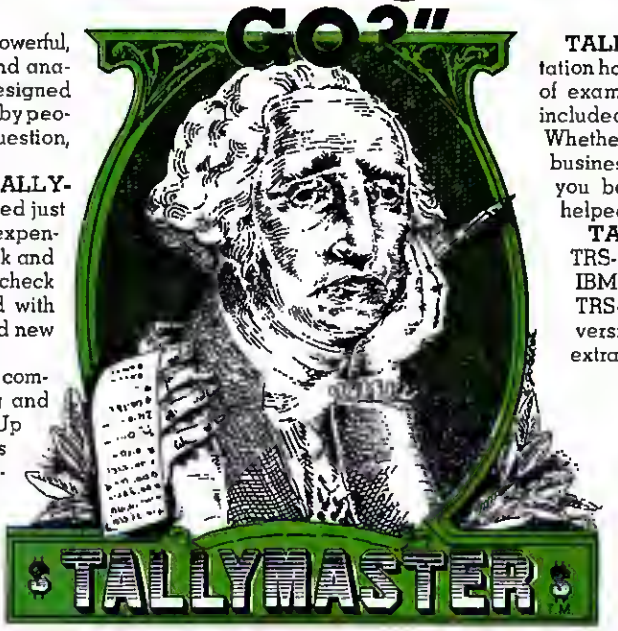

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```
Relative sectors 0EH & 0FH (14D & 15D) of BASIC/CMD in NEWDOS 80 v.2
(Model I) before modifications:

DRV 00  D977 BEC2 C957 7022 B140 11CE FF19 22A0 .w...Wp".@....".
0   10  4021 5C67 CD67 4421 FEFF 22A2 4021 CA64 @!\g.gD!..".@!.d
0H  20  22A7 4021 6943 CBBE 3A6C 43CB 773E C928 ".@!iC..:lC.w>.(
    30  067C 3221 643E C332 1243 21BB 6711 5241 .|2!d>.2.C!.g.RA
DRS 40  0193 00F3 EDB0 3E03 3289 5F21 BE66 3134 ......>.2._!.f14
99  50  65FB B728 1108 ED4B C564 3600 0B23 70B1 e..(...K.d6..#x.
63H 60  20F8 083D 20EF 3600 2322 A440 112C 0119  ...=..6.#".@.,..
    70  EB2A B140 DFDA C957 CD4D 1B21 0000 7EFE .*.@...W.M.!..~.
    80  2A20 1701 0000 2AA4 4071 2370 2100 00CD *.....*.@q#p!...
    90  5A1B 21E9 5422 5E65 1804 FE0D 2806 2189 Z.!.T"^e....(.!.
    A0  6522 0552 C319 1AE1 2133 0022 0552 C521 e".R....!3.".R.!
    B0  AC65 CD67 44ED 5B5E 652A A740 1AFE 0D77 .e.gD.[^e*.@...w
FRS C0  1323 20F8 AFF5 2BC3 7903 1D1B 1F03 0100 .#.... +.y.......
14  D0  C965 0000 0000 2A2A 237E FE3D C9C5 CDE1 .e....**#~.=....
EH  E0  6179 C1C9 ED5B C564 C900 0000 0000 0000 ay...[.d........
    F0  0000 0000 0000 0000 0000 0000 0000 0000 ................

DRV 00  0000 0000 0000 0000 0000 0000 0000 0000 ................
0   10  0000 0000 0000 0000 0000 0000 0000 0000 ................
0H  20  0000 0000 0000 0000 0000 0000 0000 0000 ................
    30  0000 0000 0000 0000 0000 0000 0000 0000 ................
DRS 40  0000 0000 0000 0000 0000 0000 0000 0000 ................
100 50  0000 0000 0000 0000 0000 0000 0000 0000 ................
64H 60  0000 0000 0000 0000 0000 0000 0000 0000 ................
    70  0000 0000 0000 0000 0000 0000 0000 0000 ................
    80  0000 0000 0000 0000 0000 0000 0000 0000 ................
    90  0000 0000 0000 0000 0000 0000 0000 0000 ................
    A0  0000 0000 0000 0000 0000 0000 0000 0000 ................
    B0  0000 0000 0000 0000 0000 0000 0000 0000 ................
FRS C0  0000 0000 0000 0000 0000 0000 0000 0000 ................
15  D0  012A C766 0000 0000 0000 0000 0000 0000 .*.f............
FH  E0  0000 0000 0000 0000 0000 0000 0000 0000 ................
    F0  0000 0000 0000 0000 0000 0000 0100 BC66 ...............f
```

Figure 1a

ing loading and writing files, defining functions, and using the extended line-editing capabilities of the DOS. Finally, use Debug to see if the space is still set to all zero bytes. If it is, you can assume the space is safe to use.

```
Relative sectors 0EH & 0FH (14D & 15D) of BASIC/CMD in NEWDOS 80 v.2
(Model I) after modifications (changes are underlined):

DRV 00  D977 BEC2 C957 7022 B140 11CE FF19 22A0 .w...Wp".@....".
0   10  4021 5C67 CD67 4421 FEFF 22A2 4021 CA64 @!\g.gD!..".@!.d
0H  20  22A7 4021 6943 CBBE 3A6C 43CB 773E C928 ".@!iC..:lC.w>.(
    30  067C 3221 643E C332 1243 21BB 6711 5241 .|2!d>.2.C!.g.RA
DRS 40  0193 00F3 EDB0 3E03 3289 5F21 BE66 3134 ......>.2._!.f14
99  50  65FB B728 1108 ED4B C564 3600 0B23 70B1 e..(...K.d6..#x.
63H 60  20F8 083D 20EF 3600 2322 A440 112C 0119  ...=..6.#".@.,..
    70  EB2A B140 DFDA C957 CD4D 1B21 0000 7EFE .*.@...W.M.!..~.
    80  2A20 1701 0000 2AA4 4071 2370 2100 00CD *.....*.@q#p!...
    90  5A1B 21E9 5422 5E65 1804 FE0D 2806 2189 Z.!.T"^e....(.!.
    A0  6522 0552 C319 1AE1 2133 0022 0552 C521 e".R....!3.".R.!
    B0  AC65 CD67 44ED 5B5E 652A A740 1AFE 0D77 .e.gD.[^e*.@...w
FRS C0  1323 20F8 AFF5 2BC3 7903 1D1B 1F03 01FA .#.... +.y.......
14  D0  C965 0000 0000 2A2A 237E FE3D C9C5 CDE1 .e....**#~.=....
EH  E0  6179 C1C9 ED5B C564 C900 E37D FE5B 2003 ay...[.d...}.[..
    F0  7CFE 1DE3 C278 1DCD 781D FE90 2804 2BC3 |....x..x...(.+.

DRV 00  781D CD78 1D38 03C3 911D CD5A 1EE5 CDC8 x..x.8.....Z....
0   10  1E2B 22FF 40E1 2BC3 781D 0000 0000 0000 .+".@.+.x.......
0H  20  0000 0000 0000 0000 0000 0000 0000 0000 ................
    30  0000 0000 0000 0000 0000 0000 0000 0000 ................
DRS 40  0000 0000 0000 0000 0000 0000 0000 0000 ................
100 50  0000 0000 0000 0000 0000 0000 0000 0000 ................
64H 60  0000 0000 0000 0000 0000 0000 0000 0000 ................
    70  0000 0000 0000 0000 0000 0000 0000 0000 ................
    80  0000 0000 0000 0000 0000 0000 0000 0000 ................
    90  0000 0000 0000 0000 0000 0000 0000 0000 ................
    A0  0000 0000 0000 0000 0000 0000 0000 0000 ................
    B0  0000 0000 0000 0000 0000 0000 0000 0000 ................
FRS C0  0000 0000 0000 0000 0000 0104 0440 E165 .............@.e
15  D0  012A C766 0000 0000 0000 0000 0000 0000 .*.f............
FH  E0  0000 0000 0000 0000 0000 0000 0000 0000 ................
    F0  0000 0000 0000 0000 0000 0000 0100 BC66 ...............f
```

Figure 1b

To find the load address of the code in the sector, scan through the entire sector looking for a 01 byte. This could be a data value, a file load marker signaling that a section of code is to be loaded, or a machine-language instruction to load register pair BC with the following 2 bytes.

If the 01 is a file load marker, it is followed by a 1-byte value indicating how many bytes are to be loaded (00=256). If you start counting from the first byte after the count indicator, the count ends on the last byte before the next file load marker (which could be on the next sector). In sector 14, the file loading marker is at relative byte 0CEH and is followed by a count of 256 (or 00).

The 2 bytes after the load marker and load count indicate the memory load address of the subsequent data. (These 2 bytes are in LSB/MSB order.) The 2 bytes at D0 and D1 indicate the load address of 65C9H. In the area of this address, make sure that Basic won't write over the zeros.

Now to install the patch. Two different patch sections are needed—one to place the code in memory and a second to place the code's address at 4004H. The 256 bytes that would have been loaded at 65C9H must be broken into two smaller pieces. You need 6 bytes of disk space to patch the RST 10H exit, so the first job is to change the load count at relative byte CFH to FAH.

The actual code is inserted on the disk starting at relative byte EAH. By using the load address of 65C9H and counting forward, you can easily calculate that this code starts at 65E1H when loaded into memory. The program code spans from the end of sector 14 to the beginning of sector 15.

Now, load the new RST 10H exit address by starting at relative byte CAH of sector 15. First, place the 01 load code on the disk followed by a 04-count byte. Then the RST 10H exit address in LSB/MSB format and the address that the main code section has in memory are zapped onto the disk. When you finish, the two sectors should look like those in Fig. 1b. Notice the change at byte CFH of sector 14; the other changes are easy to see.

Changing TRSDOS 1.3

To patch the Disk Basic in TRSDOS 1.3 (Model III), use the File Patch utility of Debug. However, Basic's password

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```
1  '*****************************
2  '*                           *
3  '*     TEST Program for      *
4  '*       RESTORE Patch       *
5  '*                           *
6  '*****************************
7  '
10 CLS
20 FOR I = 0 TO 1023
30   RESTORE 90
40   READ A$
50   PRINT A$;
60 NEXT I
70 GOTO 70
80 DATA 0
90 DATA *
```

Program Listing 2

normally keeps you from viewing or altering it. Before you start altering Basic, disable the password check in the File Patch utility by applying the following patch from TRSDOS READY:

PATCH *5 (ADD=52EB,FIND=CB, CHG=36)

PATCH *5 (ADD=52ED,FIND=BE, CHG=00)

TRSDOS Basic doesn't appear to have patch space, but room exists at the end of the file. In the directory, the end of the file is marked as the end of the 20th sector, but that sector actually ends at relative byte B9H. You can use the rest of the space without changing the directory. Also, about 300 bytes of empty space exist in memory between the end of Basic and the beginning of the Basic program (this increases when file space is reserved). Use this space for patching.

Figure 2a shows the last sector of Basic as it appears in Debug. To get to it, enter Debug from DOS Ready, then press F and answer the prompt with BASIC/CMD. Use the + key to move to sector 14H. At byte B6, you will see 0202 4D61. The first 02 is a file-loading code instructing the system to stop loading bytes into memory and to now find a transfer address (address where a program begins). The second 02 indicates that 2 bytes are used for the address. The 4D61 tells the system to jump to 614DH and start processing from there.

Move the transfer address instructions toward the end of the disk to make room for the Restore patch. The modification is shown in Fig. 2b. Starting at relative byte B6, a 01 load code and 32 (hex) count byte are entered, followed by a load address of DD64 (64DDH). Then the 48 bytes of modification are entered. At relative byte E9, another 01 load code and a 04 count are entered, followed by the address of the RST 10H exit and the new address to be patched there. Finally, starting at relative byte EF, the transfer code of 02 02 4D 61, that was originally at byte B6, is put back in. After you hit enter, the modification will be part of your copy of TRSDOS.

Sector 14H (20D) of BASIC/CMD in TRSDOS 1.3 (Model III) before modifications:

```
001400  FE21 3805 7723 1318 F636 00EB 18DA D7FE .!8.w#...6.....
001410  4DF5 2805 FE46 C297 19D7 CF3A F128 3332 M.(..F.....:.(32
001420  EC63 AF32 6E42 7ECD 5A1E FE56 2004 0186 .c.2nB~.Z..V....
001430  5864 326E 4223 7AB7 C2F0 617B FE10 D2F0 Xd2nB#z...a{....
001440  61F5 3E2A 32E4 63F1 E5CD 1E62 3600 2322 a.>*2.c....b6.#"
001450  A440 E1C3 1264 32ED 63CD 5A1E B7CA 9719 .@...d2.c.Z.....
001460  E5FD E121 AFC9 22E9 5CCD 9762 21D5 C522 ...!..".\..b!.."
001470  E95C FDE5 E1C3 1264 3AEC 63B7 2010 3E2A .\.....d:.c...>*
001480  32E4 633E 03CD 1E62 3600 2322 A440 3AED 2.c>...b6.#".@:.
001490  63B7 200D 2A11 4411 FAFF DF38 01EB CD9F c...*.D....8....
0014A0  6221 F063 7EB7 CA91 62CD E562 2119 1AE5 b!.c~...b..b!...
0014B0  21F0 63C3 B35B 0202 4D61 E5E5 E5E5 E5E5 !.c..[..Ma......
0014C0  E5E5 E5E5 E5E5 E5E5 E5E5 E5E5 E5E5 E5E5 ................
0014D0  E5E5 E5E5 E5E5 E5E5 E5E5 E5E5 E5E5 E5E5 ................
0014E0  E5E5 E5E5 E5E5 E5E5 E5E5 E5E5 E5E5 E5E5 ................
0014F0  E5E5 E5E5 E5E5 E5E5 E5E5 E5E5 E5E5 E5E5 ................
```

Figure 2a

Sector 14H (20D) of BASIC/CMD in TRSDOS 1.3 (Model III) after modifications (changes are underlined):

```
001400  FE21 3805 7723 1318 F636 00EB 18DA D7FE .!8.w#...6.....
001410  4DF5 2805 FE46 C297 19D7 CF3A F128 3332 M.(..F.....:.(32
001420  EC63 AF32 6E42 7ECD 5A1E FE56 2004 0186 .c.2nB~.Z..V....
001430  5864 326E 4223 7AB7 C2F0 617B FE10 D2F0 Xd2nB#z...a{....
001440  61F5 3E2A 32E4 63F1 E5CD 1E62 3600 2322 a.>*2.c....b6.#"
001450  A440 E1C3 1264 32ED 63CD 5A1E B7CA 9719 .@...d2.c.Z.....
001460  E5FD E121 AFC9 22E9 5CCD 9762 21D5 C522 ...!..".\..b!.."
001470  E95C FDE5 E1C3 1264 3AEC 63B7 2010 3E2A .\.....d:.c...>*
001480  32E4 633E 03CD 1E62 3600 2322 A440 3AED 2.c>...b6.#".@:.
001490  63B7 200D 2A11 4411 FAFF DF38 01EB CD9F c...*.D....8....
0014A0  6221 F063 7EB7 CA91 62CD E562 2119 1AE5 b!.c~...b..b!...
0014B0  21F0 63C3 B35B 0132 DD64 E37D FE5B 2003 !.c..[.2.d.}.[..
0014C0  7CFE 1DE3 C278 1DCD 781D FE90 2804 2BC3 :....x..x...(.+.
0014D0  781D CD78 1D38 03C3 911D CD5A 1EE5 CDC8 x..x.8.....Z....
0014E0  1E2B 22FF 40E1 2BC3 781D 0104 0440 DD64 .+".@.+.x....@.d
0014F0  0202 4D61 E5E5 E5E5 E5E5  E5E5 E5E5 E5E5 ..Ma............
```

Figure 2b

Final Comments

Run Listing 2 after modifying your operating system to be sure that you installed the modification properly. Any erratic operation will indicate a misplaced byte somewhere on the disk.

As of this writing, I have used a modified NEWDOS80 2.0 disk for over six months without any problems, but I can't guarantee that you won't have any. I tested the TRSDOS 1.3 modification, but, since I don't normally work with a Model III, I can only say that it looks trouble-free. If you have problems with the modification routine being overwritten, let me know.

Finally, let me offer one warning about the Restore modification. If you return to DOS from Basic without a reboot, the modification will still be in place and functioning. If you then execute either a library function or a CMD program that overwrites the memory area where the patch resides, and if DOS or that program subsequently uses a RST 10H command, you will have problems. The computer is likely to lock up or reboot. To prevent this, reboot every time you leave Basic to run the culprit program.

Comments and suggestions about *The Next Step* are always welcome. If you would like a personal reply, please include a SASE with your letter. You can write to me in care of *80 Micro* or through e-mail on CompuServe where my PPN is 72165,735. ■

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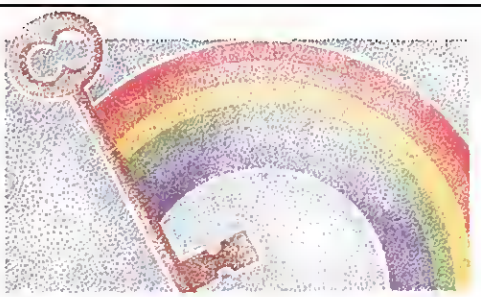
by Scott Norman



A collection of CoCo updates

This edition of The Color Key is a mixed bag. I'm giving myself some slack time in which to evaluate your reactions to the column, and I have a couple of unrelated topics I'd like to discuss.

Color Keyboard

Slowly but surely, the world is depriving me of some favorite gripes. For the past month or so I've had the pleasure of using a real keyboard on my Color Computer.

The hardware in question is a classy 57-key unit marketed by the Micronix Corp. (#7 Gibraltar Square, St. Charles, MO 63301). It's a direct plug-in replacement for the standard calculator-style keyboard, assuming you have a Series E or earlier motherboard.

Series F keyboards attach in a different manner, so if you have a late-model CoCo you might want to contact Robert Brooks at Micronix to express your interest.

I've done a complete review of the keyboard for our sister publication, *HOT CoCo* (June 1983, p. 16). All I want to say here is that the keyboard works perfectly, allowing me to get maximum efficiency from my modest typing ability.

Micronix has relocated some keys to make room for four function keys (programming to be implemented later), but otherwise there is little for the user to relearn.

The Micronix keyboard sells for $79.95, so it isn't an impulse purchase. Nevertheless, it beats the effort required to wire up and install a bare keyboard on your own. Check it out if you're into word processing in a big way.

Word Processing Progress

My enthusiasm for Howard Cohen's Telewriter (Cognitec, 704 Nob Ave., Del Mar, CA 92014) is well-known. I'm writing this column with the latest version, Telewriter 64, and it's a beauty. The product has had a prolonged gestation period, but what finally emerged was worth the wait.

Several new features have been added to my old friend, bringing it up to date with some of the other word processors that have appeared since my May 1982 review (*80 Micro*, p. 208). It is now possible to right-justify text, giving your correspondence a much more professional appearance. You can hyphenate and designate nonbreakable spaces, too.

Another welcome feature is the ability to change the position of page breaks. Have you ever prepared a thoroughly professional letter, only to have it print out with all the text on the first page and "Sincerely yours" at the top of the second?

A new command, clear-V (clear is the Telewriter control key), causes the cursor to advance through the text one page at a time so you can check page breaks. Blank lines can be added or deleted to reposition page breaks if need be, and you can mark the breaks with a nonprinting character.

The whole formatting process is aided by Telewriter's new-found ability to display three different text densities on the screen. In addition to the standard 24 51-character lines, you now have the option of going to either 64 or 85 characters.

Neither is of much use for the writing process unless you have a wideband video monitor, but the high-density formats can be handy for checking the appearance of finished material before committing it to print.

Telewriter now has user-adjustable tabs. The stops are first defined in an embedded command line that must be the first entry in the text file. The clear-enter combination advances the cursor to the next tab position from any point in the text. Previous versions of the program had predefined stops every eight spaces, unsuitable for either paragraph indentation or the composition of tabular material.

I'd like to mention two more of the many new features: the ability to generate ASCII text files, and the program's increased text capacity.

ASCII files take longer to read and write, and occupy more tape or disk space, than Telewriter's usual compressed binary files. However, ASCII is a necessity if you want to run your material through a spelling checker.

I have been using Peter Stark's Spell 'N Fix (Star-Kits, P.O. Box 209, Mt. Kisco, NY 10549) for some time; ASCII conversions have been handled by a Basic program named Convert that came with the original disk version of Telewriter.

Unfortunately, the combination does not treat Telewriter's embedded command lines properly, so a text file that has been converted to ASCII, corrected, and converted back to binary for printing will generally have to be reformatted first.

Telewriter 64 has remedied that by including a new conversion routine whose output survives everything that Spell 'N Fix and I can throw at it. One peculiarity should be noted, though: When the ASCII version of a file is listed on the screen, Telewriter 64 prefixes embedded commands with a spurious lower-case k. Ignore it; when the file is read back into memory the command lines are in their proper form.

Finally, the size of the text buffer has increased. The disk version makes almost 25K of RAM available in a "64K" machine, in contrast to the 18K available under the old v2.0. The cassette version of the new program frees almost 40K.

Before you can realize this capacity, the computer must be capable of addressing all 64K of RAM. The modification is the same as the one you would perform to use FLEX, but Telewriter itself does not require the alternative operating system. And that brings me to my next topic.

The New Breed

I detect an interesting trend: People are writing software that takes advantage of the 64K CoCo modification without requiring FLEX or any other

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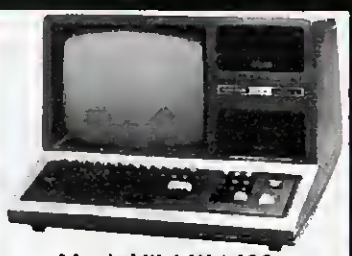

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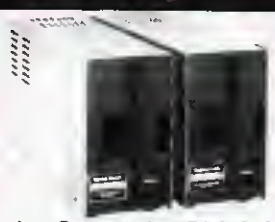

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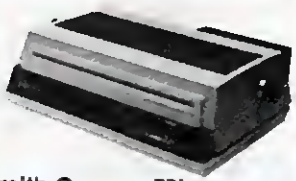

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operating system.

The programs typically contain loader routines that change the memory map to the all-RAM configuration, patch in any required portions of the Basic ROMs, and take off. The usual result is more user-available RAM.

Although my own experience with 64K word processors is limited to Telewriter 64, I should at least mention the existence of another: Text Pro II (Cer-Comp, 5566 Ricochet Ave., Las Vegas, NV 89110).

I assume that this program unfolds the CoCo memory map in the usual way, although one item on the specification sheet catches my eye: the size of the text buffer. This weighs a hefty 54K, which makes me curious as to what's left in the program.

I've been using a couple of other 64K packages recently. Spectrum Projects (93-15 86th Ave., Woodhaven, NY 11421) has produced a trio of handy utilities on a single disk: 40K, which copies the Extended Color Basic ROM to high memory, freeing an additional 8K for user programs; Spool64, which employs the unused 32K as a print spooler; and Romcrack, which allows you to make disk copies of most Radio Shack ROM packs.

The extra RAM liberated by the 40K program is available to the Basic programmer, as well as to the machine-language expert. Free memory varies from 31015 bytes with four graphics pages to 35623 bytes with a single page reserved. In all other respects, the computer plays as usual.

Spool64 performs high-speed relocation of text to the unused 32K; it is subsequently dumped to the printer. This frees the RAM normally addressed by Basic so that other tasks can be undertaken while printing proceeds at its own relatively slow speed.

Spooling is normally accomplished with outboard hardware. Spool64 provides a viable, minimum-cost alternative. It does require a printer capable of accepting data at 1200 baud, which leaves out my Line Printer VII. Thus I haven't been able to use the program myself.

Romcrack, the third utility, allows you to make disk copies of ROM programs up to 8K in length, without needing the start, finish, and transfer addresses. You can even copy programs written in position-dependent code. For example, I've used the utility to add a copy of Project Nebula to my games disk.

Once you have transferred the ROM packs, you have eliminated a potential source of damage to the computer's cartridge connection. This can be worthwhile. Disk Basic's card-edge connector is a weak point of the whole Color Computer system, and repeated switching between the disk controller and a ROM cartridge might reduce system reliability.

It might be argued that Romcrack can make pirated copies of cartridge programs. In fact, programs for locating and changing position-dependent code segments have already appeared in print.

I prefer to think of the program as a convenience for the individual whose system has grown through the acquisition of a disk drive, and who wants to have most of his software on one

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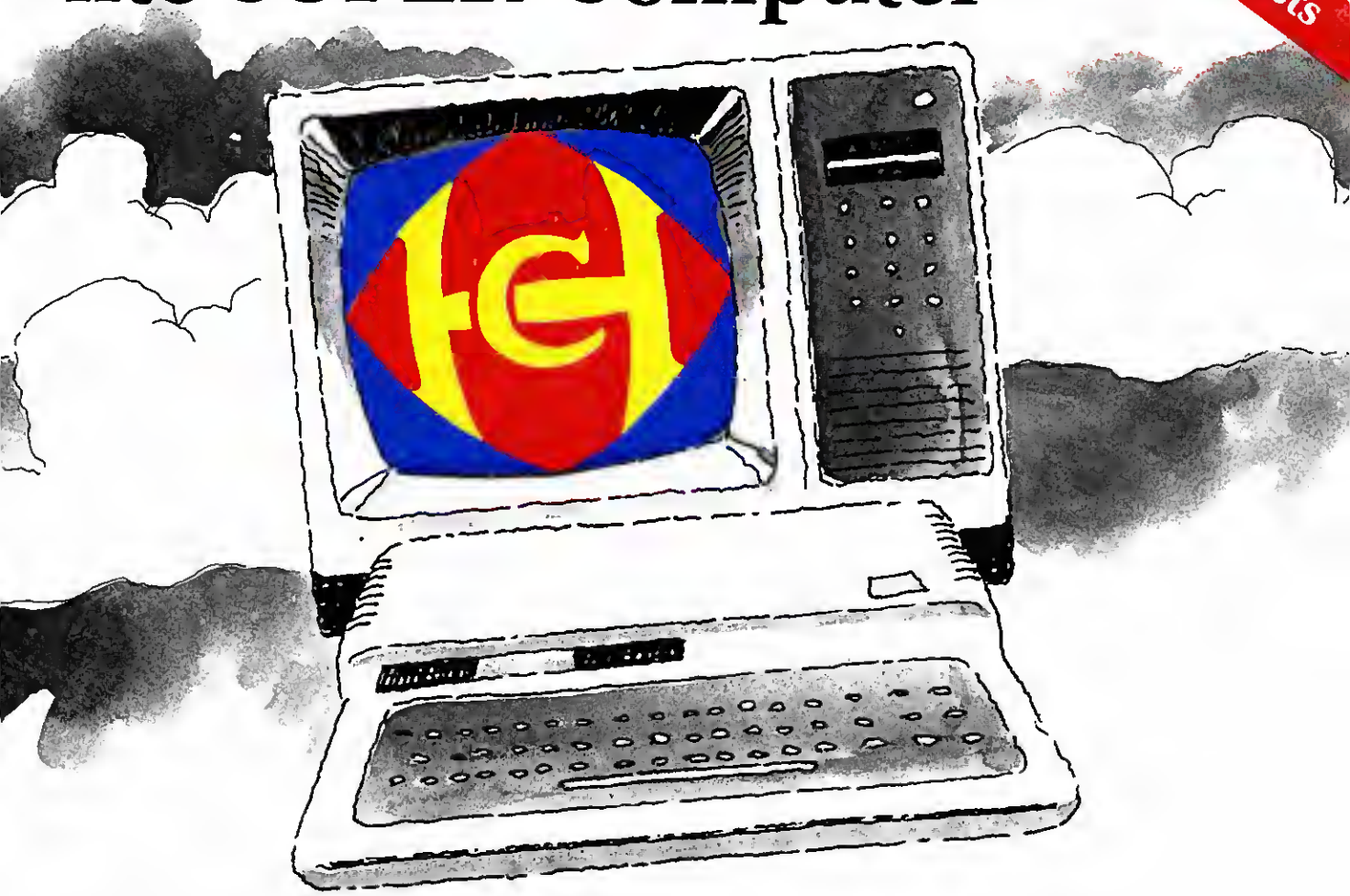

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medium. Piracy is going to exist for a long time, Romcrack or no.

Spectrum Projects' utility disk is reasonably priced at $21.95.

Another new program intended to capitalize on 64K of addressable RAM has made an appearance. It's a data-file manager called Disk Data Handler, or DDH, and it comes from Mel Hefter at Custom Software Engineering (807 Minutemen Causeway, Cocoa Beach, FL 32931). I've only taken a quick look through the documentation, but DDH looks fairly potent.

It is used to construct and manipulate data files of various types and offers a screen editor, fast sorting/selection capabilities, and flexible report formatting. DDH is also used to construct files that are further manipulated by Basic programs.

It takes time to wring out a data-management program, so the complete report on DDH will have to wait. The point I want to make now is that the Color Computer is being treated as an honest 64K machine by applications software authors.

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That's as it should be. Color Basic is fine for your own programming, but commercial applications programs should not be limited to 23K of RAM when it's so easy to free up additional memory. Maybe some combination of FLEX, OS-9, and stand-alone programs like Telewriter and DDH will finally do the job for the Color Computer.

The Shack's blessing in the form of its own official 64K machine won't hurt, either.

Good Deals

You don't need to spend a bundle to get something worthwhile for the Color Computer. There are some good low-cost products, especially if you occasionally get out of computer stores.

For example, a recent trip to a local cooking-supply outlet produced a large clear acrylic stand, intended to hold cookbooks at a convenient angle. It now sits atop my computer, holding up magazines and notepads while I type into the machine. It handles a 500-page magazine with ease, it lets me see a complete double-page spread at one time, and it cost all of $5.

I've previously gone on at some length about C.C. File, the $7 program that Bill Dye produces (Trans Tek, 194 Lockwood Lane, Bloomingdale, IL 60108). It's an electronic notebook, or memo pad, or something; all I know is that it's an extremely convenient way to store unformatted information, and I use it to record anything that doesn't deserve the full data-base treatment.

Not that Dye is the only one turning out inexpensive software. Eigen Systems (Box 10234, Austin, TX 78766) has a couple of attractive items: The Stripper and Disk Timer.

The Stripper ($7.95) is a utility that increases the efficiency of Basic programs by deleting remarks and unnecessary spaces, and by packing multiple statements onto a single program line. The idea is to save an archival copy of each of your programs, complete with explanatory remarks and the use of spaces to increase readability.

This code isn't used at run time, however. Instead, the Stripper is used to produce a tighter, faster-running version. You can always go back to the original if it becomes necessary to modify the program or to explain it to someone.

Disk Timer ($6.95) is a software tachometer. It takes ten one-second averages of disk speed and displays the individual readings and the high, low, and overall averages. A disk must be present in the specified drive.

The numbers can be helpful. Floppy drives are specified at 300 rpm, with a typical tolerance of ±4 rpm; however, my Radio Shack Drive 1 starts acting flaky above 302 rpm, and it does drift upward over a period of several weeks. My guess is that the separation between recorded sectors becomes too small for reliable I/O well before the rated tolerance is exceeded.

Removing the drive's case reveals the likely culprit: a cheap speed-control potentiometer on the motor-control board. It's a little plastic job, quite possibly susceptible to drift. I have used Disk Timer as a real-time tachometer while adjusting the potentiometer; it makes things simple.

I've added a couple of lines to Disk Timer's Basic code to display the spread between high and low speed values, expressed as a percentage of the average. I find this a useful measure of drive stability. The modification is

```
65 XX=AT * (HI-LW) * 100 / AV
66 PRINT " SPREAD =";:
   PRINT USING "#.####", XX;:
   PRINT "%"
```

The MPI drive I use as drive zero doesn't have the speed-control problem.

One More Wish

Color Computer disk-system owners learn quickly how important it is to keep the drive-controller contacts clean. I use a squirt of contact cleaner on a cotton swab to remove oxides from the controller's card-edge connector. That avoids the destructive, abrasive action of the usual pencil-eraser treatment.

The connector inside the computer's case uses gold-plated contacts and doesn't need much attention. A gold-plated connector that could be soldered to the disk-controller card would prevent oxidation at that critical press-fit connection inside the cartridge slot.

I know that someone makes a similar product for Model I connectors. Now that I have a good keyboard maybe I'll make this my new crusade. ■

Scott Norman welcomes reader response to the Color Key. Write c/o 80 Micro, *80 Pine St., Peterborough, NH 03458.*

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- Zip order is "sub-alphabetized."
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- Supports 9 digit zips, **Canadian zips,** and foreign abbrev.
- Backup data disks are easily updated as entries are created, edited, or sorted...extremely useful!!
- Optional reversal of names about commas. This permits disk storage in last-name-first order to facilitate meaningful alph. order while the printout will be in "natural" order.
- Permits telephone, account, and/or serial numbers, etc.
- Prints on envelopes or on labels, 1, 2, 3 or 4 across.
- Test label/envelope printing lets you make horizontal and vertical adjustments with ease.
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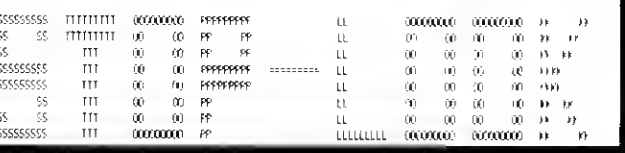

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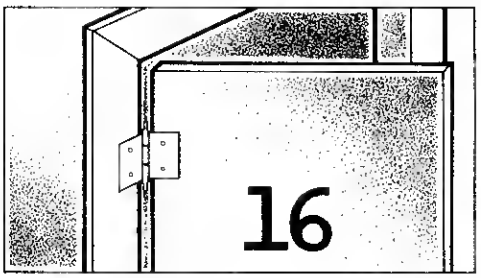
SUITE 16

by Dan Keen and Dave Dischert



Drive errors and other bugs

Mr. Jim Girardi of Ocean City, NJ, wrote a Model II program using a CP/M system from the Software House (P.O. Box 16020, Fort Worth, TX 76133). He wanted to make his program available for customers with Model 16 computers. With the Mod 16 in the Model II mode, the CP/M disk refused to recognize the second disk drive (drive 1). Every time the program tried to access the drive, a "drive not ready" error occurred.

The CP/M manufacturers already had the problem fixed. Mr. Girardi just sent them $25 and his licensed CP/M disk, and they returned a Model 16 version.

They plan to offer a Model 16 CP/M version that uses double-sided disks and the MC68000 microprocessor.

You'll also find this "drive not ready" error when you use Model II TRSDOS on the Model 16 in the Model II mode; in particular, you'll find it when you do a back-up or format on the second drive.

Model II drives rotate constantly, so they're always up to speed. If after about 20 seconds the disks are not accessed on the Model 16, they are programmed to stop rotating. This saves wear and tear on disks, but the drives take 8/10 of a second to reach the proper speed. If the computer tries to access a disk too quickly, it is signalled that the drive is not ready.

To get around this problem, copy your programs onto the latest version of Model II TRSDOS (TRSDOS 2.0b), using FCOPY. Or, you could simply copy the THINLINE utility over to your old disk. Regardless of the method used, you ultimately have to run THINLINE from the TRSDOS Ready mode. This tells the computer to wait until the disk drives are up to speed before attempting a read or write.

The TRSDOS 16 Drive command lets you set parameters to access different types of drives. This DOS command makes THINLINE and its opposite function, UNTHIN, unnecessary. Of course, if you set up the drives in the Model 16 mode and then reboot to the Model II mode, the parameters are not saved.

Engineering Literature

Motorola, maker of the MC68000 microprocessor, offers a large selection of application notes, data sheets, and other hardware-related publications. We picked up a free document on the technical aspects of the MC68000.

They also have hundreds of bulletins and pamphlets on topics such as A to D and D to A conversion, CMOS devices, memories, microprocessors, interfacing, instrumentation and control, phase locked loops, power supplies, and rf signal design.

For more information, contact Motorola's Literature Distribution Center, P.O. Box 20924, Phoenix, AZ 85036. Ask for their "Technical Literature in Inventory" directory and their "Application Note and Engineering Bulletin Catalog" number CTG3R14. ■

Assembly-Language Corner

A typographical error appeared in the February Assembly-language corner. Somehow we managed to leave a space out of a critical line.

The problem is an odd-address, trap-error message that does not show up during the assembly. The last few lines of the listing shown appear as follows.

```
MESSAGE     TEXT     '80 MICRO'
            DATAB    13
SVC BLOCK
            RDATAB   32,0
            END      BEGIN
```

A space should be included inside the quoted text so that it reads:

```
MESSAGE TEXT     '80 MICRO '
```

All instructions for the MC68000 must fall on an even-numbered memory address, because it's a 16-bit microprocessor and instructions are one word (2 bytes) long.

The instruction SVC BLOCK RDATAB 32,0 begins on an odd address because of the uneven number of bytes in the message section. The message text '80 MICRO' has an even number of characters, but the following byte, an ASCII 13 carriage return, places the next instruction on an odd address.

There are two other ways to fix the problem. An extra byte of memory could be reserved ahead of the SVC BLOCK by adding another DATAB 13 statement.

Mr. Jacob Heskes of Rockville Centre, NY, solved the problem by simply switching the message section behind the SVC BLOCK.

More Bugs

One problem with new equipment is bugs in hardware, software, or documentation.

Page 142 of the Model 16 owner's manual contains a misprint. It shows data on the CLOSEF supervisor routine. Near the top of the page is the identifying supervisor call: 133. But later on that same page, a sample program uses 265 in the EQUW instruction. 133 is actually the identifying supervisor number.

The next problems all fall under the OPEN supervisor routine section beginning on p. 177 in the manual.

First, the manual describes some-

thing called a "user attribute byte." This is a number used to identify a file within your program. On p. 178 it states "you can use zero or any number from 32-255 for this value. TRSDOS will not examine this user attribute...." Both statements are incorrect.

When we tried the number zero as a user attribute, the file became password-protected. The computer must make up its own password and protect the file. Of course, the file is valueless since there is no way to know the password. And since this password protection is activated, the disk operating system must be examining that byte.

One final major error exists in the open routine. The following excerpt is from an example showing how to use the open supervisor routine. It appears on p. 179 of the owner's manual.

```
MOVW    @A1,#WRITE ACCESS
MOVW    1@A1,#RECORD LENGTH
MOVW    2@A1,#FIXED FILE
MOVW    3@A1,#OPEN ONLY IF EXISTS
MOVW    4@a1,#USER ATTRIB
```

Line 4@a1,#USER ATTRIB should read 4@A1,#USER ATTRIB with a capital "A" for the address register.

The real problem is in the MOVW (move a word) instructions. We were unable to get the sample program to work. Since only a single byte needs to be loaded under each of the five Move instructions, we changed the W's to B's (to indicate a byte operation) and the program ran fine.

```
MOVB    @A1,#WRITE ACCESS
MOVB    1@A1,#RECORD LENGTH
MOVB    2@A1,#FIXED FILE
MOVB    3@A1,#OPEN ONLY IF EXISTS
MOVB    4@A1,#USER ATTRIB
```

We invite you to send us any comments, ideas, or errors you encounter. We will try to duplicate errors and report them to other unsuspecting programmers. ■

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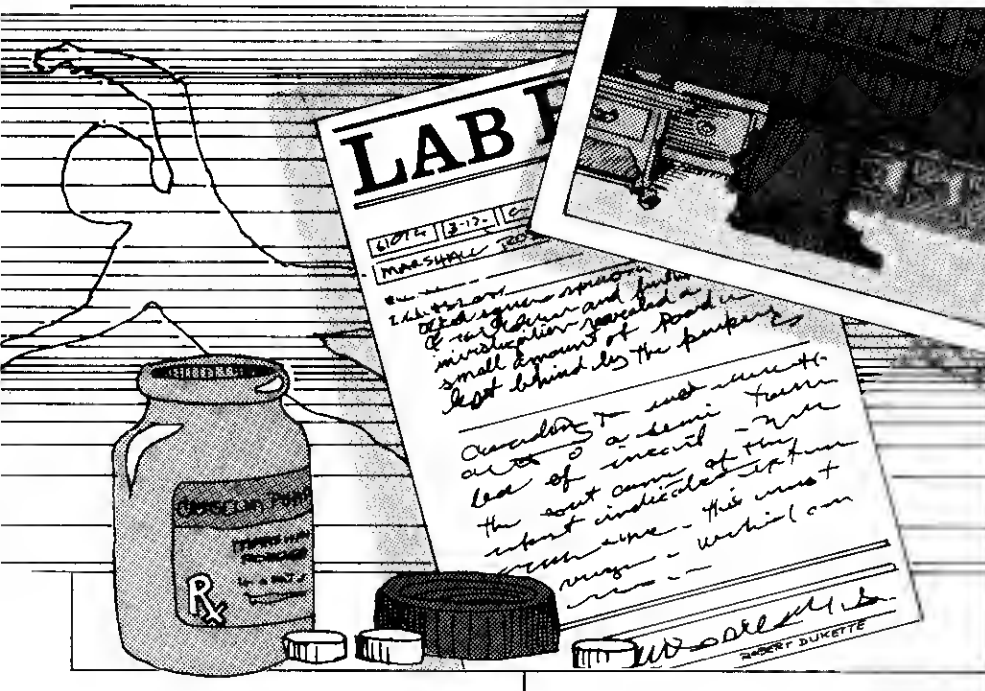

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★ ★ ★ ★ ½

Deadline
Infocom Inc.
55 Wheeler St.
Cambridge, MA 02138
Model III, 32K, one disk
$49.95

by Eric Grevstad
***80 Micro* staff**

Poor Marshall Robner. His wife is cheating on him with a ski instructor. His son George is an irresponsible wastrel, running up huge gambling debts when he's not lying around listening to records; in fact, Robner was planning to write George out of his will. His business partner, Baxter, is selling the company to a greedy conglomerate, over Robner's dead body.

Literally. One or more of the above suspects, or perhaps Robner's secretary or gardener or housekeeper, murdered him, cleverly leaving his body in a locked room with a fatal overdose of antidepressant pills, prescribed after he'd threatened suicide, in his stomach. Marshall Robner's troubles may be over, but yours are just beginning.

This is the premise of Deadline, the wittiest, most thoughtful, and most rewarding adventure yet. Apple and IBM magazines and journals like *The New York Times* have raved about the game since its debut last fall; the TRS-80 version, finally in distribution, is worth the wait.

Deadline's documentation alone is more fun than many adventures. Besides meeting your own character (a master detective, summoned by the family lawyer), you're given a full dossier on the case: coroner's and lab reports, photo of the library with overturned chair and chalk outline of Robner's body, plastic packet of pills found at the scene, and transcripts of interviews with the suspects. Your predecessors, intimidated by that pesky locked door, are ready to call it suicide and close the file.

You have 12 hours—8:00 a.m. to 8:00 p.m.—to roam the Robner mansion and crack the case. Arrest someone and a letter from headquarters purveys the result. In my attempts so far, the D.A. has refused to indict due to lack of evidence; better sleuths will obtain a trial and conviction. Move too slowly and the Chief Inspector escorts you to the door.

Deadline comes on a TRSDOS disk and lets you save games in progress on another disk. You can also make a transcript of your investigation if a printer's on line, an excellent feature. The top line of the display shows your current location and the time, which ticks away at about one minute per move. You can't examine a room and be done with it, either; the foyer that's empty at 8:30 will not be vacant at 10:52.

You're free to wander the house and grounds to search for evidence; you're aided by the indispensable Sergeant Duffy, who materializes from nowhere and whisks off to the lab when you want to analyze something ("His efficiency and quiet dedication impress you quite a bit"). Most of all, you're obliged to talk with the suspects. They range from charming to surly, and you'll find they lie through their teeth.

This interaction is carried out in the most natural, challenging prose in the adventure genre. Deadline uses complete sentences, as does the celebrated Zork series. In handling objects, "Examine the red herrings carefully" and "Put the pencil, the teacup, and the sugar bowl on the desk" are allowed. In quizzing suspects, "Mr. Baxter, tell me about the merger" and "Mrs. Robner, where is the new will?" are standard practice.

My one complaint about Deadline's vocabulary is, I suppose, that it isn't infinite. When I try something other than "Tell me about" or "Where is," the program interrupts with "Detectives are expected to know how to conduct a proper interrogation." No one will tell me whether Robner was right-handed, and I haven't been able to prompt

suspects who exclaim "Murder? But how do you know it was murder? I'm sure—" and then break off.

Even if your sentences are accepted, you'll soon be gnashing your teeth in gleeful frustration. The suspects are as cool a bunch as ever stonewalled Sherlock. They walked past me, brushed their hair, or lay down while I stood, ignored, in the bathroom or bedroom. They were never shocked into confession when I showed them bits of evidence ("Have you nothing better to do than pick up every object in the house and show it to me?").

The game taunts you as Jack the Ripper did Scotland Yard. One window, you're told, is too dirty to see through; when you retort "Wipe window," Deadline comments "Think you're clever, don't you?" and says it can't be cleaned that easily. Try something impossible ("Take bed" or "Get Mr. Baxter") and other adventures say "You can't do that." Deadline replies "Surely you jest."

In fact, part of the fun of Deadline is trying stupid moves for the sake of seeing the answers. Look under a bed, examine a toilet, try to kiss or molest a suspect or steal the silverware, or climb onto a dresser and jump off ("Wheeee!"), and you'll find Interlogic's Marc Blank ("Principal Architect," if you read the house's cornerstone) has anticipated you.

All adventures are to some extent interactive, letting you do certain things depending on whether you have certain objects. Deadline tops them all. Not only does the game know what you're toting, even if you forget ("You must be crazy, carrying that ladder inside the house!"), but the same suspect will answer the same question differently, depending on what you've discovered before asking.

In addition to different endings (carrying the Inspector Clouseau persona to the limit, I accidentally killed myself several times), the documentation hints that Deadline supports different solutions—if you find the right evidence, you can make a case against and convict several people. This should keep even competent detectives busy until summer; Witness, Infocom's second mystery, is due then.

In the meantime, I'd be happy to convict anybody, or even to get on the murderer's nerves and be killed. That would mean I'm getting warm. ■

★★★★

MicroTerm
Micro Systems Software Inc.
4301-18 Oak Circle
Boca Raton, FL 33431
$79.95

by G. Michael Vose

MicroTerm, or MTerm, is a terminal program for the Models I/III (and the IBM PC) from the folks who gave the world DOSPLUS. With MTerm and a modem, you can tune your computer into the network nation; information services like CompuServe and BSR After Dark, or one of hundreds of bulletin boards, are within your reach.

MTerm supports a range of baud rates, from 110 baud to 19.2 kilobaud. It supports automatic telephone dialing and macro-keys, which store often-used phrases or keystroke sequences.

MTerm also provides user-definable translation tables that filter printer output to translate ASCII control codes for your printer.

MTerm stores the data it captures on disk or it loads a file from disk and transmits that file to an information service or other computer.

The Features

Among MTerm's primary features is its adjustable RS-232 parameters. These parameters include baud rate, number of bits-per-data word, number of stop bits, and parity. Adjusting these parameters is simple; select "Set RS-232 parameters" and type in any new settings, or press enter to leave a current setting unchanged. The default MTerm setting for RS-232 communications is 300 baud, 7-bit words, 1 stop bit and even parity.

MTerm has two principal modes, the terminal mode, signified by a blinking dash (hyphen), and the command mode, identified by a full screen menu.

The MTerm command menu lets you change a number of settings for special communications, including your own screen's echo (duplex), elimination of carriage returns or line feeds, or putting your printer on-line to print all incoming and outgoing communications. You can change these settings with a single key.

These features are similar to many terminal programs. Where MTerm rises above the crowd is in its ability to assign frequently used phrases and keystrokes to single keys (called *macro-keys*), and its ability to store up to 10 telephone numbers for modems with an auto-dial function.

MTerm's macro-keys are useful for storing sign-on or log-on messages. For example, when you access CompuServe, your identification number and password are requested. With MTerm, you can assign this information to macro-keys to streamline your log-on—with the added plus that you don't have to remember your user number or password.

MTerm stores from one to 64 characters for each macro-key and 10 macro-keys are available.

Similarly, you can store telephone numbers that are called with single keystrokes, greatly simplifying the dialing process for your auto-dial modem.

Printer Support

One question you should always ask before purchasing a software product is, "Will it work with my printer?" With MTerm, the answer is yes. Even more important, however, is MTerm's ability to take advantage of your printer's special features.

MTerm takes care of special-feature support by providing user-definable translation tables through which all files are sent to the printer. These translation tables replace the control codes of one printer or software package with the codes required by your printer. For example, if your printer uses an ASCII 0EH to engage its double-wide print mode, you can build a translation table that converts the code used by a word-processing package or another printer to 0EH so that your printer prints in the desired mode.

Setting up MTerm's translation tables for your printer is straightforward. You'll need your printer manual to find the codes it uses and you'll need to know the printer control codes used by the program to be translated. With this information, building tables is a snap.

Utilities

MTerm comes with two utilities to transfer non-ASCII files (XFER/CMD) and to convert a file into ASCII for use with MTerm (FILECONV/CMD). These utilities enhance the power of

MTerm without complicating the main program.

The Acid Test

Using MTerm is a real pleasure. The program is fast and its screen displays are easy to understand. Its adjustable Electronic Industries Association (EIA) RS-232 communications port settings make it versatile and powerful.

Running MTerm on my TRS-80 Model III proved that the Radio Shack and IBM versions are virtually identical. I did experience some serious bit-dropping at 9,600 baud while using my Model III as a terminal hooked to a single-board computer running an Intel 8088 microprocessor. Dropping the baud rate to 4,800 alleviated the problem. I suspect MTerm had trouble sending the XOFF character to the attached computer in time to halt transmission while MTerm cleared the TRS-80 capture buffer. Another terminal program I tested under this configuration (Superterm) dropped more bits than MTerm.

"Using MTERM is a real pleasure."

With typical Micro Systems Software elan, MTerm's documentation is broken down into short, easy-to-understand chapters and sections that are written in a breezy, conversational style. The technical information is segregated from the user information so you can learn how to use MTerm without getting bogged down in the details of how it works.

The glossary at the end of the MTerm manual defines about 80 computer terms including *glitch*, labelled, "an unwanted and annoying defect...in a program or ...data file." Fortunately, glitch doesn't apply to MTerm. ■

★ ★ ★ ½

Bable Terror
Funsoft Inc.
28611 Canwood
Agoura, CA 91301
Model I or III
$19.95 cassette, 16K
$24.95 disk, 32K

by Lynne Patnode
***80 Micro* staff**

Bable Terror is an arcade-style game in the Pac-Man tradition. A high-quality maze generator and the luck required to score well are its distinguishing features.

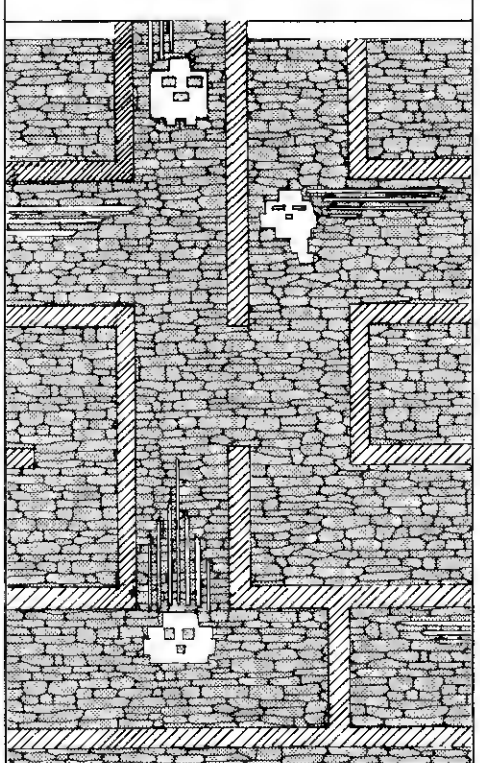
The Basics

Bable Terror takes place in a castle inhabited by hostile servants who have built a labyrinth to thwart their master's return from the Crusades. Dangerous creatures and bables randomly roam the maze's passages.

As the hero of Bable Terror you play a knight: an anxiety-ridden bumpy being with eyes that look fearfully ahead as you move through the maze via the arrow keys or a joystick. While you see the entire maze at the game's outset, throughout the game you see only a small portion of the maze; this twist adds to your anxiety.

Your life's mission is to slay bables and gather the ten twinkling treasure crosses scattered throughout the maze. Each cross you gather is worth 30 permanent points and up to a maximum of 300 temporary bonus points. The higher your permanent score, the fewer bonus points you acquire with each cross.

The bonus points are credited to an on-screen timer that counts down to zero. They give you the power to slay



bables, horrible munching creatures that become harmless and toothless as long as you have time on the board.

Each bable you slay adds 100 points to your permanent score. If you gather all ten crosses without meeting sudden death, you receive a new maze and any remaining bonus points as part of your permanent score. You also receive a new knight at every 1,000-point mark.

In addition to bables, your antagonists include two types of evil creatures: a ghost and a horned, disembodied head that looks like a demon or a dragon. These are invincible and always deadly.

Tricks of the Trade

Each game allows you three drinks of a potion that makes you invisible. In a tight spot, you quaff the potion and disappear by hitting the space bar.

Thereafter, hitting the space bar gives you a brief look at the entire maze, highlighting the locations of any remaining treasure crosses.

The most frightening parts of any maze are the long straightaways. Since your view of the maze is truncated, enemies can suddenly appear in your path and catch you unprepared.

The Best and the Worst

Bable Terror's best feature is its maze generator. After dozens of games, I've yet to see two identical mazes. All of them are complex and challenging.

This seemingly endless variety of mazes gives the game its fascination. Unfortunately, you are not allowed to finish the maze if you're slain by one of the evil creatures. This might be frustrating to anyone who enjoys a puzzle for its own sake.

Sometimes Bable Terror is annoyingly repetitive. You might be trapped by a series of creatures that you must dodge one at a time in exactly the same manner. You can get quite bad-tempered repeating the same sequence of movements over three square inches while the rest of the maze goes unexplored.

Continues on p. 45

"THE RESULTS ARE IMPRESSIVE..."
—Dennis Kitsz, 80 Microcomputing: 12/82

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Don't let price get in the way of owning a quality printer.

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THE POWER BEHIND THE PRINTED WORD.

The new STX-80 printer for only $199.*

Continued from p. 42

The game's most questionable aspect is its high incidence of luck. Because the creatures move randomly, you become at the mercy of chance once you become familiar with the game. It soon becomes difficult to discern any improvement in your ability to feud off evil creatures.

Features

The disk version of Bable Terror contains a permanent top-ten scoreboard, a nice feature in any video game. You can also freeze the action.

Bable Terror comes with sound that includes the usual loading and welcome noises and a special sound during maze generation. These are little more than background distractions.

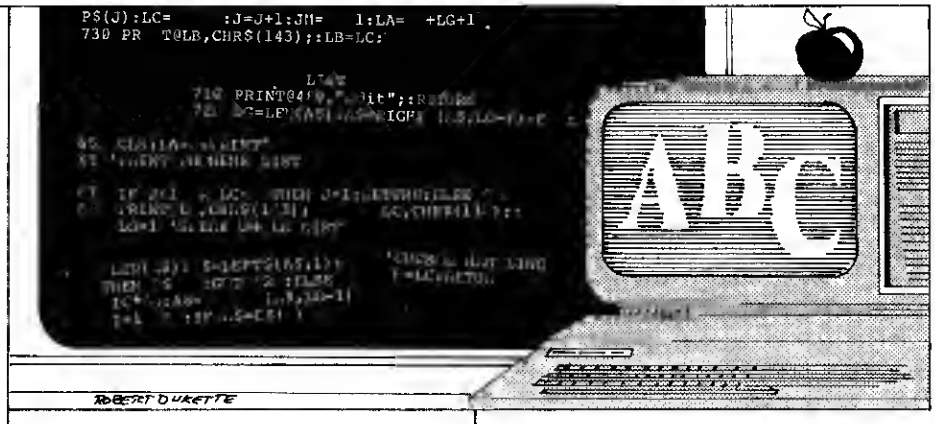
Other noises are more useful: You are signaled when you run out of bonus points and when you accumulate 1,000 permanent points. Once you recognize these two sounds, you can concentrate on the maze and ignore the point displays.

Finale

This is a video game for existentialists. Death is dealt randomly, regardless of your ability or just deserts. If you take satisfaction in pitting yourself against the inequities of luck, you'll enjoy the game. If you're frustrated by the daily repetitions of life, you'll enjoy it only until it becomes all too familiar.

Bable Terror is an addictive, well-designed game. Just make sure you're the right personality type for battling bables. ■

"This is a video game for existentialists. Death is dealt randomly, regardless of your ability or just deserts. If you take satisfaction in pitting yourself against the inequities of luck, you'll enjoy the game."



★★★

Color Pilot
Tandy/Radio Shack
Fort Worth, TX 76102
Color Computer
$59.95 cassette
$79.95 disk

by Carlos Calle

Color Pilot is a language designed to help you write teaching programs. Pilot stands for Programmed Inquiry, Learning, or Teaching. The original Pilot was developed in the early 1970s at the University of California at San Francisco. The latest standard Pilot, called Common Pilot, was developed by George Gerhold and Larry Kheriatry at Western Washington University.

Color Pilot is based on this standard but includes special extensions and features to take advantage of the Color Computer's graphics. Nevertheless, most programs written in Common Pilot run on Color Pilot.

Color Pilot has 16 statements and eight graphics commands with five statement modifiers. Table 1 lists the Color Pilot statements. Each of the five statement modifiers can be used with any statement to change its operation. Digit conditioners determine whether an instruction is executed.

Color Pilot allows high-resolution graphics (256 by 191 pixels) in four colors. The normal characters (24 lines by 32 characters) are not regular Color Computer characters, but a new set drawn on the graphics screen. The 96

Symbol	Name	Description	Comments
R	Remark	R:any remark text	Ignored by Pilot
T	Type	T:text	Types to screen
:	Continue Text	:continue text	Continuation line of a Type statement
M	Match	M:pattern	Matches answer
A	Accept	A:answer text	Inputs answer
J	Jump	J:label J:@	Program jump to label or to last Accept executed
U	Use	U:label	Subroutine call
E	End	E:	Return from subroutine
W	Wait	W:number	Number of tenths of second to pause
X	Execute	X:VARIABLE$	VARIABLE$ is executed
N	Newchar	N:number, HEX	Defines new characters
C	Compute	C:expression	Provides for calculations
D	DIM	D:VARIABLE$	Reserves string space
SS	Sound Start	SS:	Turns on and off cassette tape and plays through TV speaker
SH	Sound Halt	SH:	
V	Video	V:variable	Controls video tape or video disk
G	Graphics	G:list	Graphics commands

Table 1. Color Pilot Statements

ASCII characters with full upper- and lowercase allow text and graphics on the screen simultaneously. A double-size text of 16 characters by 12 lines is also available. Shift/zero turns on and off the shift lock. Pilot supports true lowercase characters with descenders. Once you're in lowercase mode, the shift key produces uppercase characters.

Color Pilot Modes

After loading Pilot and executing the machine-language program you are in Command mode, signified by the prompt Pilot:. Eight commands are available in this mode:

- L: Load a Pilot program from cassette or disk.
- S: Save a program on cassette or disk.
- R: Run a program in memory.
- E: Enter Edit mode.
- P: Print program in memory.
- I: Enter Immediate mode.
- Shift/clear: Clear program area.
- Break: Enter Command mode from Run, Enter, or Immediate modes.

Three other modes are available:

- Immediate mode executes any Pilot statement immediately. This mode is useful when writing programs since you can enter it from the Edit mode by pressing the break key. Then type your statement and see exactly what it does.

"Color Pilot allows high-resolution graphics (256 by 191 pixels) in four colors."

This option is essential for any kind of graphics.

- Run mode executes a Pilot program. Pressing break stops the execution and returns you to Command mode.
- Edit mode allows you to write Pilot programs. You can exit to Immediate mode to try out any feature and return to Edit mode without disturbing your program.

The Editor

Color Pilot provides a fairly good screen editor. Immediately after you enter the Edit mode by pressing E from Command mode, the screen blanks and the cursor appears at the lower left corner. If no Pilot program exists in memory, the cursor is all you see and the computer is ready to accept program statements. If there is a program in memory, only the first line appears at the bottom of the screen, with the cursor immediately below the first character. You can change the line or scroll through the text line by line or all at once.

By pressing shift in combination with any one of the four arrow keys you can scroll up, down, left, or right. However, the up and down arrow commands are backwards—Shift/up-arrow takes the cursor down through the text. You should interpret this command as bringing *text* up instead. Even the man-

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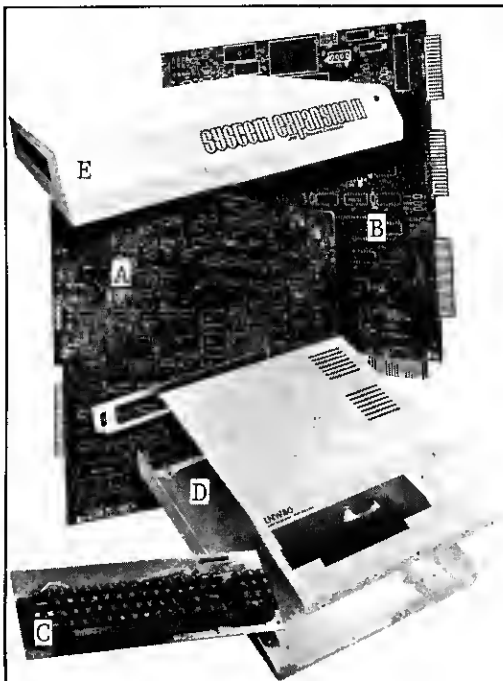

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nal instructions are backwards on this point (p. 32).

The editor is vastly superior to the Extended Color Basic editor. It is not a true screen editor, however, because it handles instructions that fit only on a single line.

Drawbacks

Color Pilot is far from perfect. Take, for example, the Sound command. The statement SS, sound start, turns on the cassette tape and plays the recorded sound through the TV set, explains the manual. SH (sound halt) does the opposite. And that's all the sound provided. The Color Computer's impressive sound capabilities are unused.

Using eight graphics commands, you can draw triangles, squares, rectangles, little houses, small cars, even little people if you're artistically inclined. You can fill enclosed areas with colors and draw lines with different colors, too.

But Color Pilot doesn't even know joysticks exist! Say you want to draw a nice triangle somewhere in the middle of the screen. You must type the following command:

```
G:E,D120,150,L80,100,L160,100,L120,150
```

This determines the starting point (Dx,y = D120,150) and the lengths of the three sides (Lx,y, where (x,y) are the coordinates of the end point of each line). The third side must go back to the initial point. Three joystick motions and four hits of the joystick fire button would accomplish the same thing faster and without calculations.

Another annoyance: In Immediate mode, the cursor is left at the end of the line after a command is executed. Since this isn't true in Edit mode, where you are most of the time, it is difficult to remember to bring down the cursor before entering another command. The first character entered is always chopped off.

The manual is well-written and assumes you know nothing. However, it doesn't have an index.

Although there are no Motor On-Off, Audio On-Off commands in Color Pilot, the sound commands SS and SH set the cassette motor and the audio output on and off. You can use them in the Immediate mode to avoid pulling the plugs on the cassette deck to position the tape before loading or saving a program.

"Using eight graphics commands, you can draw triangles, squares, rectangles, little houses, small cars, even little people if you're artistically inclined."

Conclusions

Color Pilot is suitable for teaching when you have complete control of the computers. It would be difficult to set up in a computer laboratory for students to use unattended because the program has to be loaded into memory for the lessons to run. ■

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Review in 80 Microcomputing

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FOR THE FULL STORY SEE PAGE 43

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★★★

Everything You Always Wanted to Know About Home Computers
Narrated by Steve Allen and Jayne Meadows
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New York, NY 10019
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by Eric Grevstad
***80 Micro* staff**

If you have any doubt that computers have entered the mainstream, listen to this: that durable commercial couple, Steve Allen and Jayne Meadows, offering a 40-minute guide to RAM, ROM, and Basic on Donna Summer's old label, Casablanca. Forget *Time*'s Machine of the Year cover story. If the micro rates an Allen/Meadows album, it's safe to say it's come out of the closet.

While the album jacket says "Steve and Jayne answer those important questions about the home computer," the answers really belong to Arnold Friedman, a teacher in the Great Neck and Bayside, NY schools and author of the album text.

The text, slightly changed in the recording script, is supplied in a handy booklet, which also contains a glossary ("All the words and terms you'll need to understand and speak the 'computer language' ") and one of those useless keyboard diagrams to practice on.

The glossary is quite good, though vague on topics like the difference between compilers and interpreters. The keyboard diagram, "set up just like a real home computer keyboard," features up and left but no down or right arrows, as well as the familiar plus, minus, semicolon, asterisk, and equals-over-colon keys.

Side one of the album sets the tone early. After a recording of a rocket-launch countdown and some jazzy elevator music, Allen declares "Welcome to the computer age. Welcome to the 21st century!" Meadows establishes the level of repartee with "What? It's already here? I must have overslept."

The narration continues in this vein through an overview of computer theory (the four sections: input, memory, central processing, and output) and applications. For the most part, Meadows plays the ingenue, confessing "I thought computers were huge, complex, expensive machines run by Ph.D.s in white coats" and wondering whether software has something to do with ladies' lingerie.

Allen explains the difference between instructions and equipment with the old saw "If you can kick it, it's hardware." The phrase "booting a disk" never comes up.

After Allen's patient definitions of words like "byte" and "RAM" ("Have you ever been bitten by a ram, Steve?" "No, Jayne, just by the computer bug"), the two proceed to list standard reasons for micro ownership—financial management, inventories of books or recipes, education, word processing, data-bank access, games, and so on.

Meadows reassures listeners that

"Allen explains the difference between instructions and equipment with the old saw 'If you can kick it, it's hardware.' "

"You don't have to buy all your software," mentioning user's groups and clubs that offer it "at practically give-away prices, sometimes just for the cost of a blank tape." This would seem to be a hearty endorsement of software piracy.

Side one ends with a brief comparison of the types of micros available. The phrase "color computer" is used generically, though the album photos show Allen visiting a CoCo-owning family.

Such a machine seems to be the pair's choice—they dismiss $100, membrane-keyboard models as useful only for people who spill things on them, and Meadows says that a $200 unit looks "like a pretty good deal, when you realize that prices for computers alone can go up to several thousand dollars."

Side two, accompanied by background noises of clicking recorder buttons and computer keys, combines more explanation—"Stripped of all the gobbledygook, when you get right

down to it, a computer is simply nothing more than an enormous number of switches that are contained in the chips"—with some elementary programming exercises.

An imaginary datebook program introduces the mechanics of loading and running; from there, Allen and Meadows dip a toe in the ocean of Basic, cautioning listeners not to mistake Basic for English ("Beginners in programming frequently confuse the two languages, which thoroughly confuses the computer").

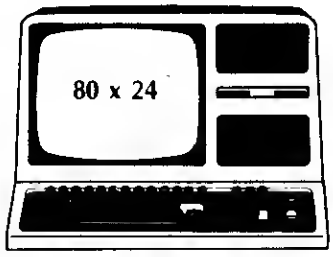
The sample programs are traced step by step, with care to explain the difference between 10 PRINT "2+3=" and 20 PRINT 2+3, but it's beyond the scope of the album to give any kind of meaningful introduction. By the end, Allen and Meadows have added Input to Print statements and written a Fahrenheit-to-Celsius program, but side two leaves a decidedly skimpy impression.

"I could wish for Stiller and Meara, but Allen and Meadows' amiable expertise makes the album a painless introduction."

Compared to computer guides in bookstores, *Everything You Always Wanted* is a novelty item. It's less intimidating, but less thorough; it seems aimed at an adult or middle-aged audience rather than the mass market. Too, it's hard to skip back and reread sections of an LP. It might be easier to buy the cassette and sit by the rewind button.

But these shortcomings aren't Allen and Meadows' fault. Their jokes are creaky—"A home financial program can keep track of food, utilities, and charge accounts." "I'd like to know more about your charge accounts, Jayne"—and their asides and chuckles are no doubt part of the script, but the two veteran professionals run through the material without a hitch.

I could wish for Stiller and Meara, but Allen and Meadows' amiable expertise makes the album a painless introduction. ■



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TRSDOS 2.3 Decoded & Other Mysteries
James Lee Farvour
IJG Inc.
1953 West 11th St.
Upland, CA 91786
Softcover, 304 pp.
$29.95

by John B. Harrell, III

The TRS-80 Information Series, published by IJG Inc., is among the many superior publications now available documenting the Model I's hardware and software. James Farvour has followed his superior work, *Microsoft Basic Decoded & Other Mysteries*, with Volume VI, *TRSDOS 2.3 Decoded & Other Mysteries*. This book disassembles TRSDOS and explains each line of coding clearly and concisely.

TRSDOS 2.3 Decoded guides any programmer through TRSDOS's internal operations. You need no programming experience to understand or use this reference, but you must understand the basic architecture of a computer and have some experience in Assembly-language programming.

TRSDOS 2.3 Decoded consists of ten chapters covering various topics related to the disk operating system and its Model I implementation. Two appendices cover the data structures used by the operating system and Assembly listings of each operating system overlay, complete with comments.

The experienced reader can skip the chapters covering basic organization of the computer and generalizations on operating systems. A practiced programmer can read the remaining chapters in any order. Though much of the specific source code is not applicable to users with more sophisticated operating systems, many of the topics are valid for all operating systems and provide excellent insight into systems programming.

The first chapter, a thorough description of Model I hardware, illustrates the use of the Z80 microprocessor in the TRS-80 environment. It discusses input/output operations and explains the memory-mapped addresses where required. The last part of the chapter discusses operating systems in broad terms as a preview to succeeding chapters.

The second chapter provides a general introduction to TRSDOS. It describes the functions and assigned memory addresses for the core-resident nucleus. A discussion of each system's overlay files provides the reader with a complete overview of the operating system prior to delving into the complex internal structures. One of the key data structures for any operating system is the disk directory, and chapter 2 provides its format.

The heart of TRSDOS is the SYS0/SYS file. It contains TRSDOS's nucleus and is always core-resident after you load the system. Mr. Farvour describes how the ROM routines and the boot loader contained in BOOT/SYS load the nucleus. He uses hexadecimal addresses to bracket his description of short code segments.

> *"TRSDOS 2.3 Decoded guides any programmer through TRSDOS's internal operations. You need no programming experience to understand or use this reference, but you must understand the basic architecture of a computer..."*

Where applicable, particularly important code segments are reproduced. Mr. Farvour uses this style throughout the book for emphasis.

A large section of the third chapter describes interrupt processing on the Model I. Mr. Farvour explains file operations and the disk file manager as part of the nucleus system. He includes an excellent description of managing file space on disk. Next comes a thorough explanation of the disk file loader and overlay loader, and the format of load (CMD) files.

Mr. Farvour considers SYS1/SYS the brain of TRSDOS. In chapter 4, he explains how the command-line interpreter reads and executes commands for the system, then loads and executes the appropriate system command or user file. SYS1/SYS does this by working in harmony with SYS6/SYS to execute all standard TRSDOS commands.

Most interesting is the discussion of the function calls to SYS1/SYS that move character strings and validate them as file names, add a three-character extension to a file name, and parse parameter lists. This extremely powerful feature allows the programmer to pass complex parameters to his routines that the system interprets prior to execution.

Chapter 5 details the operation of SYS2/SYS, part of the TRSDOS file management system. The book presents many examples of disassembled coding to discuss the operations of Open and Init processing related to disk files. SYS2/SYS also contains the source code to determine the encoded value for passwords. As directory space is limited for a single file entry, it might be necessary to create an extension (overflow) entry linked to the file primary directory entry. Chapter 5 discusses the code for this SYS2/SYS function in detail.

To complete the discussion of the file management procedures, chapter 6 presents the details of SYS3/SYS. This system overlay contains the code to process disk file Close and Kill requests.

The nucleus calls system overlay SYS4/SYS whenever the system routines detect any error condition, and it can be invoked whenever user programs detect similar errors. SYS4/SYS provides the code necessary to interpret these error codes and to display comprehensible error messages.

Mr. Farvour points out a facility in SYS4/SYS that is not used by TRSDOS; it provides detailed error processing during debugging. SYS4/SYS is interesting because its unique data structure provides full error messages. This technique demonstrates a good method of text compression and is not limited to Assembly language.

Chapter 8 is devoted to Debug (SYS5/SYS), a machine-language monitor overlay integrated into TRSDOS. This overlay provides many useful examples of good programming techniques. The design objective was to keep the overlay small and within the bounds of the system overlay buffer. The techniques involved are valuable.

The book describes SYS6/SYS as the only overlay to load in the memory

Continues on p. 53

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Continued from p. 50

region above 5200H. It contains the coding necessary to perform the bulk of TRSDOS's commands. Chapter 9 clearly describes the many differences between SYS6/SYS and the other system overlays. This is the longest chapter in the book, with many comments on SYS6/SYS functions. It's interesting to study routines you've wanted to modify for your own use.

The last chapter details the operation of the boot loader contained in the read-only memory and on the system disk as BOOT/SYS. Mr. Farvour paces you through the system functions from the time you press reset until the time SYS1/SYS reads the first command.

Mr. Farvour describes BOOT/SYS as the only core-image program in TRSDOS. This means that sector zero of track zero is read into memory and executed as it exists on disk, unlike the other programs that require a system loader to read them into memory. This is incorrect. Sector zero is also a loader-format file. When you execute it with the command BOOT/SYS.WHO and depress the 2 and 6 keys while loading, it displays the proprietary notice from Tandy.

The NOP (00H) and CP (FEH) instructions located in the first 2 bytes of the sector are cleverly disguised loader codes that cause the system loader to skip the boot loader and go to sector 1 to continue.

Appendix I contains a clear and concise representation of all data structures used in TRSDOS. All entries in the nucleus module (SYS0/SYS) and the appropriate calling sequences are also listed. A nice feature of this appendix is the cross-reference showing all references from one overlay to another.

Appendix II provides the full source code to TRSDOS, complete with comments. The source code is in assembler output format, fully ready for reassembly if the industrious programmer wants to make changes to the system. This feature alone justifies the book's cost.

Mr. Farvour's book has one additional benefit: It identifies many errors that exist in TRSDOS 2.3. With this book and a disk file editor, you can make patches to correct these mistakes or add additional features yourself.

TRSDOS 2.3 Decoded is a valuable addition to the TRS-80 Information Series. I highly recommend it for the Model I owner's reference library. ■

★★★

Plus Explained
Crest Software
2132 Crestview Drive
Durango, CO 81301
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by Wynne Keller

Crest Software's *Plus Explained* details the finer nuances of the sometimes confusing Profile III+ documentation.

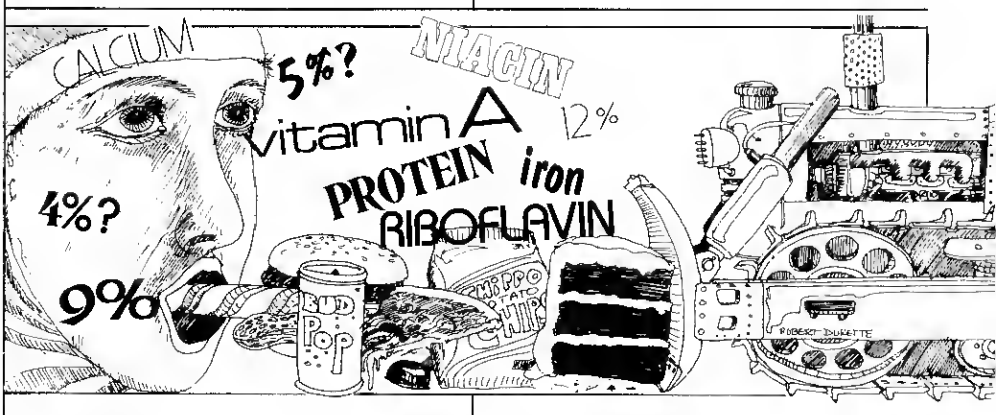
The manual is daisy-wheel printed on yellow paper. The pages are numbered and punched to correspond with the Radio Shack version of the Profile III+ documentation. You insert each Crest page adjacent to the proper Radio Shack page. If you recall, however, Profile III+ is available from another company as well. My version of the data base came from The small Computer Company, and the page numbering is different. It would have been useful if Crest had included both sets of page numbers.

As I first read the Crest manual, I was irritated by the colloquial grammar and puns. Further along, though, the relaxed style began to appeal to me. Leave staid text to standard documentation; an explanatory manual is allowed a light touch.

There are two potential users of this manual: those who didn't understand the original Profile III+ manual, and those who understood it but want to know more. Crest's manual meets the needs of the first group. If data bases in general, and Profile in particular, leave you confused, *Plus Explained* will help a great deal. The second group won't obtain as much benefit from the Crest manual, but at $12, it's still informative and worth the price.

The package also includes two flowchart posters. The posters are available separately for $2. They are nicely designed, but are most useful when used along with the manual. I recommend that you purchase the whole package, not just the posters, if you need help with Profile.

A final suggestion: the Radio Shack *TRS-80 Microcomputer News* has been running a series of Profile III+ articles that may be useful to you. They begin with the October 1982 (Vol. 4, No. 9) issue. ■



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First Things First

The Nodvill Diet Program totals the nutritive values of all the foods you eat during a given period of time and determines whether you've met your Recommended Daily Allowance (RDA) of nutrition. The program uses TRSDOS Version 1.3 and comes on disk without

an operating system.

Before you can use the program, you have to back up or copy the programs and data files on your own working disk. Use the utility program on your operating system disk. Nodvill Software recommends that you use two disk drives. It's not necessary, but it saves you from formatting several disks for a one-disk-drive unit.

The Nodvill Diet Program consists of six separate program modules: Main Menu, RDA Chart, Food List, Meal Menu, Daily Menu, and Grocery List. The display for each program is divided into two sections: an information-display area in the upper portion of the screen, and a control-option prompt in the lower section.

The information area displays the information and data for whatever program module you select and the control area lets you perform specific functions. Each program allows you to display existing data, add new information to a file, or edit a record that requires corrections or modifications.

RDA Chart

This is probably the most important of the five diet-oriented programs. All the other programs directly or indirectly refer to this RDA chart for comparative information.

The program menu prompts you for your name, sex, age, weight, height, and energy level. You can roughly determine the latter from an energy expenditure chart in the back of the manual. The chart lists the calories you burn during different activities. For example, walking 3¾ miles in an hour burns off 300 calories, and playing an hour's worth of tennis burns 420 calories. Select your normal activity and enter it into the RDA chart.

After you enter this personal information, the program displays how many units of niacin, iron, calcium, phosphorus, protein, calories, and vitamins A, B1, B2, and C that your body requires on a daily basis. With this information, you can modify your diet so you receive the nutrients your body needs.

One pleasing program feature is its taking into account whether a woman is pregnant or lactating. These are important factors since both conditions have a marked effect on a woman's body chemistry nutritive needs. I'm only surprised that the software didn't consider menstruation as well. This would seem to play a more important role in determining a woman's dietary needs each month, especially her mineral requirements.

Food List

Pizza, beer, potato chips, sponge cake, brownies, peanuts, and pecan pie all make one's stomach growl in hunger and anticipation. But are these tempting morsels good for you? Before you chow down next, why not consult the Food List program?

The program consists of 734 individual foods. For each item, the program provides a complete nutritional breakdown, including the amount of calories, vitamins, and minerals it contains, and how much protein, fat, carbohydrates, water, and fatty acids are

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present. What more could you ask?

Well, let me tell you. The program scans and displays all 734 food entries one at a time if you are trying to decide what to eat, or it searches out a particular item on the list at your request. The program has entries for all five basic food groups, plus a special junk-food data file.

If you can't find a certain food item, the program lets you add it to the list. Enter the measure and the nutritional values, both found on the food label. If you've come across an unusual measure for the food, such as grams or sticks, an equivalency chart in the back of the manual translates it into a common measure.

Meal Menu

Now that you know your daily nutritional needs and are aware of the nutritive value of your favorite foods, you can use the Meal Menu to put together the perfect meal for yourself, be it breakfast, lunch, dinner, or a snack.

You can enter up to ten individual food items for each meal. As you enter each item, the program displays the cumulative amount of nutrients and calories of the meal. This allows you to alter either the food item or its quantity in order to meet your individual caloric and nutritive requirements.

Planning a meal is easy. You can either use the computer to search the food list for a specific item and enter its record number, or you can search the food list by food group, going through each until you find something that whets your appetite.

After selecting, say, chicken, enter how much you plan to serve or eat and the computer determines its caloric and nutrient value.

Each meal is labeled with a record number and meal type (breakfast, lunch, and so on) so you can easily refer to it and change it if necessary.

Daily Menus

The Daily Menu helps you plan meals for an entire week on a day-to-day basis. Each daily menu displays the meals you've selected and the percentage of your daily vitamin, mineral, protein, calorie, carbohydrate, fat, and fatty acid requirements. Obviously, you aim for 100 percent in each category.

This program works closely with the Meal List. In fact, all entries you make for this program must first be entered on the Meal List program. If you're planning a menu, first make certain that the meal exists on the Meal List.

Each daily menu is found by its record number, the weekday, or your name. If you're undecided as to what to eat tomorrow, search through your entire menu file by the weekday to see what menus you've had in the past. Once you find a menu that makes your stomach growl, stop the computer scan and enter it for your present menu.

Grocery List

Now for the icing on the cake: Nodvill Software provides a grocery list program with their package. The program scans and displays each daily menu for the present week meal by meal. As you

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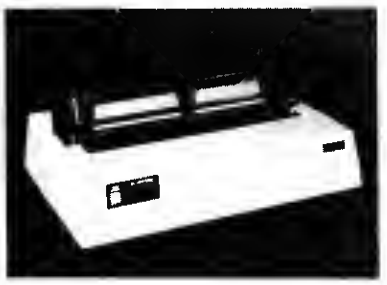

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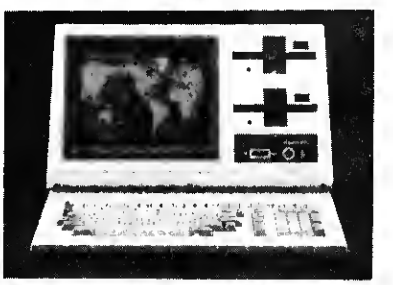

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Continues on p. 61

review the meal list, check your refrigerator and cabinets for the food items listed. If you don't have the required items, enter its record number.

When you've finished reviewing the menu, the screen displays a grocery list of the items you need to buy. The next time you go to the store, print this list out and take it with you. You'll never have to worry about forgetting to buy something again!

Extras

Nodvill Software recognizes that this dietary program is only as good as the person using it. An individual unfamiliar with nutrition might actually harm himself by accidentally designing meals of little nutritive value.

In order to prevent this, they include a Meal and Menu Planning section in their manual to guide the user in proper meal planning. They also provide dieting tips, a list of food sources with additional nutrients, and an example of an average day's diet.

"One word of warning: The Nodvill Diet programs are not planned for those with special health or nutrition problems."

Whether you're a serious athlete, a weekend recreationist, or an individual concerned with your health, this program is ideal for tracking and analyzing your eating habits. Each program comes with sample data for you to follow. You can change these to suit your eating habits and adapt them to your nutritional needs.

One word of warning: The Nodvill Diet programs are not planned for those with special health or nutrition problems. If you are in this category, consult your physician before using the programs.

Although many might balk at the program's $69.95 price, let me assure you that it is worth every penny, thrice over! Not only will you be pleased with it, you'll feel secure in knowing that your body receives all the vitamins, minerals, and calories that it needs on a daily basis.

This professional and detailed program is the Cadillac of dietary software. ■

★★★★★

D-92 Printer
Data Impact Products Inc.
745 Atlantic Ave.
Boston, MA 02111
$399.95

by Terry Kepner

What would you think of a printer that gives you six programmable printing modes, six different printing pitches, six or eight lines per vertical inch spacing, an 800-character buffer, data processing (7 by 9) and correspondence quality (11 by 9) print modes, selectable unidirectional or bidirectional printhead movement, 100-characters-per-second print speed, and costs only $399.95?

The D-92 has all these features and more. The printer is small, only 17 inches wide by 9.75 inches deep by 6.5 inches high, but in that small space it delivers a lot of power. The print speed is impressive, especially when you consider that the Radio Shack DMP 100, also $399.95, is rated at 30 cps.

The D-92 Dual Mode Printer

With this high speed you get the full upper/lowercase 96-character ASCII set, with descenders and underline. The character modes are as impressive as the speed. The data-processing mode is good enough to be compared to the correspondence-quality modes of other printers.

The six programmable printing fonts are actually two sets of three fonts, one set in the data-processing mode and the other set in the correspondence-quality mode. Each set contains: a standard font (one-pass), an enhanced font (two-pass), and an expanded font (each character double-width).

Similarly, the six pitches are two sets of three: 10, 12, and 16.5 characters per inch. One set is in standard mode and the other is in expanded mode (double-size characters that produce 5, 6, and 8.25 characters per inch). See Table 1 for six pitches available (40, 48, 66, 80, 96, and 132) and a sample of the enhanced printing.

The character buffer's capacity is 800 characters (about ten lines of print), so it lets your program operate at higher efficiency than nonbuffered printers. The printer prints the characters as you fill the buffer.

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If you fill the buffer, your computer waits for the printer to print a character before it sends another. As long as you don't fill the buffer before the printer can print all the characters you send, your computer operates at full speed without waiting for the printer to finish before going to the next part of your program.

One odd but intriguing feature of the printer is its built-in serial and parallel interfaces. Only one of them is connected, depending on whether you order a serial or parallel printer.

As a further oddity, the manual warns you that changing the configuration of your printer from serial to parallel, or vice versa, voids the factory warranty, but then it tells you how to do it! The RS-232 option supports baud rates of 110, 150, 300, 600, or 1200 baud. Higher baud rates are optional.

The printer has three front panel controls: Single Line Feed, Form Feed, and Printer Select/Deselect. A self test mode comes with the line feed and form feed switches. In addition to these switches, you have an on/off switch and a form size selection switch that allows you to select any number of lines per page as a form. Software can override the form size switch.

These are all standard features. The character fonts, printing modes, pitches, underline, form length, uni- or bidirectional print head movement, carriage return, line feed, form feed, and line density (6 lpi or 8 lpi) features are all available through software control.

The printer is well-designed. The print ribbon is accessible without removing the cover. A single row of DIP switches inside the printer controls the RS-232 controls, self-test mode, and printer line feed/carriage return response. You remove four screws and lift the cover to get at them.

One disadvantage of the printer is the lack of a paper platen knob. You have to use the line feed or form feed switches to advance the paper. Form feed advances the paper five lines per second. However, you can feed paper from the bottom, back, or top of the printer.

The manual is the printer's biggest failing. Its instructions are incomplete. It does describe how to use the standard features, but the descriptions of how to use dot-addressable graphics are poor. The manual does not contain even one example of a graphics command and what it prints.

From a hardware point of view, the manual is exceptional, giving thorough descriptions of how to connect the RS-232 port to your printer (including hardwiring the printer to match your computer's nonstandard RS-232 port), directions to maintain and troubleshoot the printer, several real pictures of the inside of the printer with important parts identified, and a parts layout drawing of the printed-circuit board.

The documentation needs a short summary page of the various control codes and the effect they have on the printer.

If you want more than the standard features, you can get a tractor feed mechanism for $50, dot-addressable graphics with four plot densities from 33.3 to 66.6 dots per inch for $30 (graphics requires the tractor feed option), a switch at the back of the printer to select either 7-by-11 character fonts for $20, a 2K memory buffer for $35, a serial port for $60 (parallel is standard), a cut-sheet feeding tray for $45, remote printer control (Control X, Control Y) for $20, a sound cover for $30, and optional X-on/X-off serial buffer control for $60.

A completely configured printer costs $749.95, but a printer with dot graphics, tractor feed, and sound cover (what the average user wants) costs only $509.95. These prices don't include the cost of a cable ($30–$40) or extra ribbon cartridges ($14.95, with a print life of five million characters).

The dot-addressable graphics are straightforward: Each line of graphics is 512 dots wide by six dots high. Set the printer to graphics mode, send 512 bytes of graphics data, and watch the printer print. The top dot is the least significant byte of each column.

Recently, the options for the D-92 were on sale for 25 percent off list, a substantial discount. If you're interested in this printer, check with Data Impact Products to see if the discount is still available, or if the prices have changed.

What I liked best about this printer is that 60 seconds after I opened the box the printer was connected to my computer and printing merrily away. After seeing and reviewing many printers, this is the one I'll buy for my personal use. ■

```
80 CHAR

 !"#$%&'()*+,-./0123456789:;<=>?
@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_
`abcdefghijklmnopqrstuvwxyz{|}~
40 CHAR

 !"#$%&'()*+,-./0123456789:;<=>?
@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_
`abcdefghijklmnopqrstuvwxyz{|}~
96 CHAR

 !"#$%&'()*+,-./0123456789:;<=>?
@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_
`abcdefghijklmnopqrstuvwxyz{|}~
48 CHAR

 !"#$%&'()*+,-./0123456789:;<=>?
@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_
`abcdefghijklmnopqrstuvwxyz{|}~
132 CHAR

 !"#$%&'()*+,-./0123456789:;<=>?
@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_
`abcdefghijklmnopqrstuvwxyz{|}~
66 CHAR

 !"#$%&'()*+,-./0123456789:;<=>?
@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_
`abcdefghijklmnopqrstuvwxyz{|}~
ENHANCE PRINT

 !"#$%&'()*+,-./0123456789:;<=>?
@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_
`abcdefghijklmnopqrstuvwxyz{|}~
```

Table 1

★ ★ ★ ★ ★
Telewriter 64
Cognitec
704 Nob Ave.
Del Mar, CA 92014
Color Computer, 64K
$49.95 cassette, $59.95 disk
(Discounts available when upgrading from earlier versions)

By Scott L. Norman

Telewriter 64, the latest version of Howard Cohen's powerful word processor, exemplifies the third wave of Color Computer software. It takes advantage of the CoCo's ability to disregard Color Basic ROMs and address 64K of RAM. It's also a stand-alone program; it senses the amount of memory available, and requires no other operating system to set the memory map to 64K.

I have been using Telewriter almost since its inception. I reviewed version 1.0, the original cassette rendition (*80 Micro*, May 1982, p. 208). By the time the review appeared in print, I had acquired a disk drive and moved on to version 2.0, which became my most-used program. Cognitec has eliminated almost all of the few remaining deficiencies with Telewriter 64.

Upgrading from 32K to 64K gives the user more memory in which to store text. The text buffer doesn't double in size, though (at least not in a disk system), because Telewriter 64 is considerably larger than its predecessors. Many new features have been added, enough to make a re-examination worthwhile.

I'll skip over most of the features common to previous versions of the program. If you are curious but completely unfamiliar with Telewriter, you should know that it is a complete package for preparing and editing text, and for formatting the resulting material for printing.

It features a full-screen editor, high-density text displays with character sets defined in software, and a set of commands that you can embed in the text for real-time control of print parameters like margins, line lengths, and character fonts.

The embedded commands take the form of uppercase letters, sometimes followed by numbers. Since the Color Computer has no separate control key, Telewriter identifies them as commands rather than text through the clear/period (.) combination.

This causes the control character ^, an upward caret, to appear on the screen when you enter embedded commands. For brevity, the key sequence clear/./x will be represented by ^ X in this review.

Refer to my earlier review for further details of Telewriter's basic operation. I want to concentrate on Telewriter 64's new features. I'll refer to the package as TW64, from now on. Also, I'm going to consider only the disk version, based on my experience.

Important Enhancements

If the computer has a good 64K RAM aboard, TW64 gives the user just under 25K of text buffer in the disk version and 40K with cassettes. This is certainly a worthwhile improvement over the 18K or so provided by earlier versions in a 32K computer, but in a way it's the least of the program's enhancements.

"Cognitec has eliminated almost all of the few remaining deficiencies with Telewriter 64."

Of greater significance are other features including optional right justification of printed text, high-density screen formats for checking the appearance of text before printing, page-break finders for avoiding awkward-looking printouts, tab stops, and an additional utility program for ASCII file I/O (input/output).

Aligned, or justified, right margins improve the appearance of almost any prose. Formal business correspondence, school reports, and manuscripts certainly look better that way. Earlier versions of Telewriter could not add spaces to a printed line in order to square up the right margins, but TW64 incorporates this feature with a single command.

Like its predecessors, TW64 has three screen menus: Main, Format, and Disk I/O. One of the new format options is called justify. Like everything else on this menu, it is a numerical parameter that you can alter from the keyboard. The default value is zero, or no justification.

To square up the right margins, type J/1/enter. This is standard Telewriter procedure: The first letter of the option generates a blinking cursor in the appropriate place on the menu, and entering the new numerical value completes the update cycle.

I timed TW64 printing single pages with and without justification, and didn't see any significant difference. However, my Line Printer VII runs at a miserable 600 baud; a faster printer might reveal whether or not the justification process has any measurable effect on speed. In any case, the screen display as TW64 pads a line with blanks is entertaining enough to make up for any slight time loss.

Sometimes you might want to protect a block of text from justification. You can insert the new embedded command ^; before and after the text that you do not want justified.

Even if you don't use justification, this command is useful for keeping a series of short lines, set flush against the left margin, from being merged into a single line by TW64's alignment command. Earlier versions of the program required that you indent each unaligned line two spaces and precede it with a ^.

Only the final printout is justified by this option. The video still exhibits ragged right margins. The new high-density text options make the display itself much more useful for general formatting than ever before.

Line and Page Options

Telewriter previously offered a 24-line by 51-character video format. TW64 adds two options: 64 or 85 characters per line. These normally use their own three-pixel-wide character set. You can toggle back to the standard four-pixel-wide character set by entering clear/;. However, this is marginal for 64-character lines and almost useless for anything longer.

The high-density options aren't much good for text entry and proofreading unless you have a good video monitor and a baseband output modification for your computer. Their value lies in checking the formatting of printed

Telewriter-64™

the Color Computer Word Processor

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- **Embedded format and control codes**
- **Runs in 16K, 32K, or 64K**
- **Menu-driven disk and cassette I/O**
- **No hardware modifications required**

THE ORIGINAL

Simply stated, Telewriter is the most powerful word processor you can buy for the TRS-80 Color Computer. The original Telewriter has received rave reviews in every major Color Computer and TRS-80 magazine, as well as enthusiastic praise from thousands of satisfied owners. And rightly so.

The standard Color Computer display of 32 characters by 16 lines without lower case is simply inadequate for serious word processing. The checkerboard letters and tiny lines give you no feel for how your writing looks or reads. Telewriter gives the Color Computer a 51 column by 24 line screen display with *true lower case characters*. So a Telewriter screen looks like a printed page, with a good chunk of text on screen at one time. In fact, more on screen text than you'd get with Apple II, Atari, TI, Vic or TRS-80 Model III.

On top of that, the sophisticated Telewriter full-screen editor is so simple to use, it makes writing fun. With single-letter mnemonic commands, and menu-driven I/O and formatting, Telewriter surpasses all others for user friendliness and pure power.

Telewriter's chain printing feature means that the size of your text is never limited by the amount of memory you have, and Telewriter's advanced cassette handler gives you a powerful word processor without the major additional cost of a disk.

...one of the best programs for the Color Computer I have seen...
— Color Computer News, Jan. 1982

TELEWRITER-64

But now we've added more power to Telewriter. Not just bells and whistles, but major features that give you total control over your writing. We call this new supercharged version Telewriter-64. For two reasons.

64K COMPATIBLE

Telewriter-64 runs fully in any Color Computer — 16K, 32K, or 64K, with or without Extended Basic, with disk or cassette or both. It automatically configures itself to take optimum advantage of all available memory. That means that when you upgrade your memory, the Telewriter-64 text buffer grows accordingly. In a 64K cassette based system, for example, you get about 40K of memory to store text. So you don't need disk or FLEX to put all your 64K to work immediately.

64 COLUMNS (AND 85!)

Besides the original 51 column screen, Telewriter-64 now gives you 2 additional high-density displays: 64 × 24 and 85 × 24!! Both high density modes provide all the standard Telewriter editing capabilities, and you can switch instantly to any of the 3 formats with a single control key command.

The 51 × 24 display is clear and crisp on the screen. The two high density modes are more crowded and less easily readable, but they are perfect for showing you the exact layout of your printed page, *all on the screen at one time*. Compare this with cumbersome "windows" that show you only fragments at a time and don't even allow editing.

RIGHT JUSTIFICATION & HYPHENATION

One outstanding advantage of the full-width screen display is that you can now set the screen width to match the width of your printed page, so that "what you see is what you get." This makes exact alignment of columns possible and it makes hyphenation simple.

Since short lines are the reason for the large spaces often found in standard right justified text, and since hyphenation is the most effective way to eliminate short lines, Telewriter-64 can now promise you some of the best looking right justification you can get on the Color Computer.

FEATURES & SPECIFICATIONS:

Printing and formatting: Drives any printer (LPVII/VIII, DMP-100/200, Epson, Okidata, Centronics, NEC, C. Itoh, Smith-Corona, Terminet, etc).

Embedded control codes give full dynamic access to intelligent printer features like: underlining, subscript, superscript, variable font and type size, dot-graphics, etc.

Dynamic (embedded) format controls for: top, bottom, and left margins; line length, lines per page, line spacing, new page, change page numbering, conditional new page, enable/disable justification.

Menu-driven control of these parameters, as well as: pause at page bottom, page numbering, baud rate (so you can run your printer at top speed), and Epson font. "Typewriter" feature sends typed lines directly to your printer, and Direct mode sends control codes right from the keyboard. Special Epson driver simplifies use with MX-80.

Supports single and multi-line headers and automatic centering. Print or save all or any section of the text buffer. Chain print any number of files from cassette or disk.

File and I/O Features: ASCII format files — create and edit BASIC, Assembly, Pascal, and C programs, Smart Terminal files (for uploading or downloading), even text files from other word processors. Compatible with spelling checkers (like Spell 'n Fix).

Cassette verify command for sure saves. Cassette auto-retry means you type a load command only once no matter where you are in the tape.

Read in, save, partial save, and append files with disk and/or cassette. For disk: print directory with free space to screen or printer, kill and rename files, set default drive. Easily customized to the number of drives in the system.

Editing features: Fast, full-screen editor with wordwrap, block copy, block move, block delete, line delete, global search and replace (or delete), wild card search, fast auto-repeat cursor, fast scrolling, cursor up, down, right, left, begin line, end line, top of text, bottom of text; page forward, page backward, align text, tabs, choice of buff or green background, complete error protection, line counter, word counter, space left, current file name, default drive in effect, set line length on screen.

Insert or delete text anywhere on the screen without changing "modes." This fast "free-form" editor provides maximum ease of use. Everything you do appears immediately on the screen in front of you. Commands require only a single key or a single key plus CLEAR.

...truly a state of the art word processor... outstanding in every respect.
— The RAINBOW, Jan. 1982

PROFESSIONAL WORD PROCESSING

You can no longer afford to be without the power and efficiency word processing brings to everything you write. The TRS-80 Color Computer is the lowest priced micro with the capability for serious word processing. And only Telewriter-64 fully unleashes that capability.

Telewriter-64 costs $49.95 on cassette, $59.95 on disk, and comes complete with over 70 pages of well-written documentation. (The step-by-step tutorial will have your writing with Telewriter-64 in a matter of minutes.)

To order, send check or money order to:

Cognitec
704 Nob Ave.
Del Mar, CA 92014 ↙ 121

Or check your local software store. If you have questions, or would like to order by Visa or Mastercard, call us at (619) 755-1258 (weekdays, 8AM-4PM PST). Dealer inquiries invited.

(Add $2 for shipping. Californians add 6% state tax. Allow 2 weeks for personal checks. Send self-addressed stamped envelope for Telewriter reviews from CCN, RAINBOW, 80-Micro, 80-U.S. Telewriter owners: send SASE or call for information on upgrading to Telewriter-64. Telewriter-compatible spelling checker (Spell 'n Fix) and Smart Terminal program (Colorcom/E) also available. Call or write for more information.)

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material.

TW64's main menu has a new option, C (for characters/line), that allows the video display to duplicate the length of a printed line. Usually you compose text in the default 51-character mode for best readability, then reset the C parameter to the desired length of a printed line and switch to one of the high-density modes for final checking.

The manual advises choosing the mode greater than the desired printer line width. If you want to print 60-character lines, set C to 60 and select the 64-character mode with the command clear/:. Clear/@ brings up the 85-character mode and clear/zero gets you back to 51 characters.

Incidentally, if you change the C parameter in this way, you find your new value preserved when you call up the format menu. C is only accessible from format in earlier versions of Telewriter.

The relationship between the display mode, which defines the maximum possible length of a video line, and the C parameter, which sets the actual length, is a little hard to grasp at first. It is worth the effort to do so, however, because the ability to tinker with the display is the key to enjoying several of TW64's advanced features.

Page breaks, for instance, look unprofessional when they split the closing of a letter. It isn't attractive to have the first line of a paragraph at the bottom of a page, or the last line at the top of one. Full-featured word processors allow the user to examine the points at which pages of text end so you can take corrective action to avoid such embarrassments.

A new Vertical Tab command advances the cursor by exactly one page to give an on-screen indication of where the breaks appear in the printed material. Of course, you must first set up the format you use for printing so that the program can count margins, characters per line, and lines per page correctly. Use the format menu and choose the proper display mode.

Once you establish the format, you can examine page breaks by moving the cursor to the top of the text and hitting clear/V repeatedly. Each stopping point is the first line of a new page. If you don't like where it falls, you can fix it.

Corrections usually take the form of additional blank lines or an embedded new page command to force a new paragraph to begin at the top of the next page. You can also rewrite some material when page breaks occur in the middle of paragraphs.

Once you make such a change, go back to the top of the text or to a previous page break to continue scanning. The very last examination should always begin at the top, because embedded changes in line width (^C commands) can temporarily fool the system.

In general, the page-finder routine takes proper account of such changes as they occur. However, confusion can result when you make page break corrections in the middle of a section that uses a temporarily altered line length.

Although this application is not stressed in the manual, the page finder is also useful for skipping rapidly up and back through large sections of text. It provides an alternative to scanning text one video screen at a time.

The page finder ignores embedded command lines and nonprinting comments when counting the lines per page. You have to make an allowance for headers printed at the top of each page, though.

"In general, the page-finder routine takes proper account of such changes as they occur."

To get the line count right, the format menu's upper margin parameter U must be temporarily set to a fictitious value. The recipe is (True upper margin) + (Number of line feeds between header and text) + 1. Remember to reset U to its correct value before printing.

I slipped in something about nonprinting comments two paragraphs back. They are another new feature of TW64, and make use of a versatile new embedded command: ^T.

^T corrects one annoying deficiency of earlier Telewriters: the lack of user-definable tab stops. To set tabs in TW64, you use ^T followed by a series of two-digit numbers as the first line in a text file.

For example, the command line that sets up indentation for paragraphs and the inside return address on my correspondence is:

```
^T  04  40  49
```

(Print lines begin at 00, so 04 refers to the fifth position.) The clear/enter combination serves as the tab key.

Incidentally, tabs are always referenced to the left margin of the text, not the edge of the paper. Your text stays in order if you change the margin later.

If ^T, followed by a space, appears anywhere other than the top of a text file, whatever follows on the same line is treated as a nonprinting comment. Thus you can put permanent page break markers in your text. Such comments are useful to remind yourself of the purpose of complicated sets of embedded commands—just as a Basic REM statement can jog your memory.

If ^T is followed by a bit of text without an intervening space, that text is printed but isn't subject to alignment (if it is less than half a line long). You can use this for the inside address of a letter, although I prefer to enclose the entire thing in a pair of ^; commands.

ASCII I/O

One important TW64 feature is the dramatically improved ASCII I/O capability. Telewriter normally writes tape or disk files in the binary format used by SAVEM and associated commands. However, it is often useful to create ASCII files; that's the format used by spelling checker programs, for one thing.

Cognitec included a conversion routine called CONVERT/XXX with earlier Telewriter disks, but it had some flaws. The worst was its inability to guide certain formatting commands through a complete binary-ASCII-binary conversion routine.

The TW64 disk now contains two copies of the normal binary I/O file names S/XXX and S/BIN, and S/ASC, which does the same job in ASCII. When you invoke the main menu's D command to call up the disk I/O menu, you normally get S/XXX.

To generate an ASCII file, you must return to Basic with the B command and enter RUN "S/ASC". The screen then displays another disk I/O menu, but with an "ASCII I/O" title.

Any text file generated before the switch is still in RAM. You can save it

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through this menu and manipulate it with other programs. You get an active video display during the save, by the way.

You can subsequently read the corrected files back through S/ASC and save them again in binary with S/XXX, if you like. That's the drill for using a spelling checker. Although it takes several minutes to write the ASCII file, the advantage of the new system is that all embedded commands are handled properly.

In a single-drive system, you must copy S/XXX and S/ASC onto each disk used for text files. If you have multiple drives, you need them only on the system disk in drive zero.

Should you know ahead of time that you'll be doing a lot of ASCII I/O, you can avoid much of the menu swapping. Make another work disk with S/ASC as the only I/O control file, and rename it S/XXX. Calling for disk I/O automatically sets you up for ASCII operation.

Cassette-based TW64 systems also support both output formats, although it requires a little more work. Appropriate I/O files are found on the flip side of the system tape.

Other Features

TW64 has several other features and some of them are interesting. I will not cover Cognitec's rather convoluted schedule of prices for upgrading from earlier versions of the program; contact them directly for that information.

Prior versions of the program required that you precede embedded command lines with a space to keep the alignment routine from blending them into one long line. This is no longer necessary; apparently the presence of the ^ control character in the first position of a line is enough.

Telewriter has always been able to send control codes to a printer through the embedded D command. For example, the line

```
^D2 31
```

defines a control character (2) that, when invoked, tells my LP VII to shift to double-width print. The invocation consists of typing clear/2, which inserts a reduced-size 2 that looks rather like an exponent, into the text.

TW64 has a new wrinkle: It is now possible to print some of these control codes. The definition command is ^DP, followed by the appropriate numerical value. For example, the ASCII value for the up arrow is 94, so

```
^DP3 94
```

means that clear/3 embedded in text causes such an arrow to be printed: ^.

Wild card characters have been added to the global search/replace options. The ubiquitous ^ in any position of a search pattern causes that position to be treated as a wild card and ignored.

One handy example mentioned in the documentation is finding multi-word combinations that might be split by a carriage return in the final text. For instance, specify

```
abra^cadabra
```

as the search taget results in a match even if "abra" came at the end of one line and "cadabra" at the beginning of the next.

"As you can tell, I think a great deal of TW 64. It is now my standard tool for text processing and that means something like 10,000 words per month of final-draft material."

TW64's format menu has been revised. In the old days, page numbers were always centered at the bottom of each sheet. A new option, W(here), allows the user to specify the numeral's position along a print line.

You calculate the position by adding the value of the left margin to the number of spaces by which the figure should be indented. Five spaces in from a ten-space margin means a W value of 15.

In fact, page numbers need not appear at the bottom at all. You can incorporate them in a header through the use of the backslash character, obtained by hitting clear/,. The backslash goes into the header definition line at the place where the number is to appear. You still have to specify the initial page number through the N parameter on the format menu.

Now you can print a header on the first page of a manuscript. Just follow the H in the definition line with a plus sign before specifying the number of blank lines between header and text.

Another new format parameter, O(ne Page), instructs the program to pause and await another print command after printing a single page. This is useful for correspondence on single sheets in a friction-feed printer. The default value is zero, change it to anything else less than 128 to get the pause.

Telewriter's ability to handle specific printers is expanded. The old E(pson) parameter has been changed to something called EPS/OKI/LF, and now treats special line-feed/carriage return combinations. It can also specify whether or not the Graftrax option is present on an Epson MX-80.

Summing Up

As you can tell, I think a great deal of TW64. It is now my standard tool for text processing, and that means something like 10,000 words per month of final-draft material.

In terms of features, TW64 is beginning to approach even WordStar, the standard of comparison from CP/M systems. The comparison will be even more valid if Howard Cohen produces a mail-merge package. The possibility is mentioned in the TW64 manual, so this is more than speculation.

Of course, I still wish for a Move command that would automatically delete a chunk of material from its old location after a move. As things stand, TW64 users still have to do a block copy followed by a delete operation.

The ability to verify information written to disk without emptying RAM would be nice, too. Cassette Telewriter users have been able to do this all along. And how about printing headers and footers? Or different headers on alternate pages?

The fact that such questions are appropriate is a measure of TW64's maturity. It is worthy of consideration as a writing tool for major projects, perhaps even up to book length. That's a compliment to the program, and to the Color Computer itself. ■

REVIEW DIGEST

Pocket Magic, Bill R. Behrendt, Prentice-Hall Inc.; 96 pp., $17.95 hardcover, $9.95 softcover.

"Just as a dog is not meant for bipedal locomotion, the TRS-80 PC-1 is not designed for computer game playing. . . .Behrendt's games are certainly ingenious, and he is to be congratulated. But even his efforts cannot turn the PC-1 into a decent game-playing machine. For little more than the price of the PC-1, and certainly for the price of the PC-2, one can buy a computer that will allow the playing of far superior games."*Personal Computing*, April, p. 150.

Sands nf Egypt, Tandy/Radio Shack, Fort Worth, TX 76102; Color Computer, $29.95.

"Sands of Egypt is more than an adventure, it's an animated adventure. You tell the computer you want to go east and the scene on your screen shifts as you walk east. If you dig and find an object, you see the object. . . .Because of its excellent use of graphics animation, Sands of Egypt represents a new standard for adventure games." *The Color Computer Magazine*, April, p. 56.

The Genie in the Computer: Easy Basic Through Graphics (TRS-80 Edition), Rachel Kohl, Laura Karp, Ethan Singer, John Wiley & Sons Inc.; 169 pp., $12.95, softcover.

"Learning to write Basic programs for the TRS-80 Model I and III doesn't have to be a long, laborious task. If you can put your intellectual ego aside for a few hours, turn on your machine, open *The Genie in the Computer*, and prepare to have some fun while learning the fundamentals of programming. Simple-minded language or not, this book will have you writing a program by the time you finish page two, which compensates for whatever flaws it may have." *Personal Computing*, April, p. 149.

Audio Spectrum Analyzer, Tandy/Radio Shack, Fort Worth, TX 76102; Color Computer, $20.

"Every hi-fi buff is a fun lover at heart, and there is no denying that the Spectrum Analyzer is a lot of fun. In the kaleidoscope mode, it becomes a low-cost color organ with added capabilities such as freeze-frame. In the graph mode, the correspondence between music and display is absolutely mesmerizing. If you're the type of person who likes to *watch* the Mahler symphony, the Audio Spectrum Analyzer is well worth investigating." *Popular Computing*, April, p. 193.

The Professional Keyboard, Spectrum Projects, 93-15 86th Drive, Woodhaven, NY 11421; Color Computer, $89.95.

"Once in place what we had, essentially, was a Model I keyboard in a Color Computer case. The fit was perfect. The touch was good and there were no real problems. . . .We have heard more complaints about the Color Computer's keyboard than anything else. For those of you who do not like it, the Professional Keyboard offers an excellent alternative that is well put together and works without any problem." *the Rainbow*, March, p. 20.

Preread, Prickly-Pear Software, 9822 E. Stella Road, Tucson, AZ 85701; Color Computer, $24.95.

"If you have a young child you would like to see receive a head start in reading, Preread, by Prickly-Pear Software, is an excellent tool with which to begin. Three programs are contained within the Preread package. They can teach the young child from three years up important letter recognition. . . .My son, a kindergartner, thoroughly enjoyed all three programs. They keep the child's interest and are viewed as a game, not a test, although a percentage score is given at the end of each program." *the Rainbow*, March, p. 172.

TRS-80 Data Communications Systems—A Guide to the Operation of TRS-80 Microcomputers as Communication Devices, Frank J. Derfler, Jr., Prentice-Hall Inc.; 170 pp., $12.95 softcover.

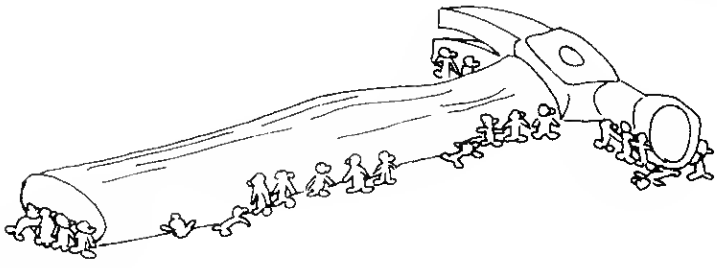
"Communications expert Frank Derfler characterizes our present age as 'the second great information explosion,' and compares it to the 'third wave' of the industrial revolution. Against this backdrop comes the easy availability of high-technology computer equipment, in sophisticated communication settings, and in kitchens and dens across the nation.

"The personal computerist first needs a friendly introduction and reference in data communications to guide him through the maze of new concepts and jargon. Derfler's book. . . provides a concise but thorough explanation of personal computers as communication devices. It concentrates on the hardware and software for TRS-80 microcomputers." *Softside*, March, p. 75.

Stinger, Eigen Systems, P.O. Box 1806, Austin, TX 78766; Color Computer, $34.95 ROM Pak, $24.95 cassette, $29.95 disk.

"The objective of Stinger is to capture as many honey bees as possible. You have six bee catchers at your command. They attempt to capture honey bees by overtaking each one and landing on top of it. The honey bees are protected by stinger bees and the Queen bee, which emits killer bees if the stinger bees have trouble protecting the honey bees. When a stinger or killer bee catches one of your bee catchers, they kill it. The game is over when you lose all six bee catchers. . . .Stinger provides a high degree of excitement and a good test of your motor skills." *The Color Computer Magazine*, April, p. 62.

Drivers and DCBs



by Jerry Lindsly

Are you curious about machine-language programming? The ROM subroutines explained and demonstrated here will help you learn.

ROM subroutines make machine-language programming easier. Basic ROM, Disk Basic, DOS, and machine-language programs use driver routines to communicate with various input and output devices. An I/O driver is used each time an I/O request is made. Standard drivers for keyboard, video, printer, and cassette devices are built into the ROM for Level II users, while disk users find some of them located in RAM as well, along with disk I/O drivers.

Drivers are machine-language routines with the logic needed to input or output information to or from a specific hardware device in a system.

A driver can be located anywhere in memory. Therefore, if you plan on writing your own drivers or enhancing present ones, be certain that the RAM areas used by your routines don't conflict with RAM areas used by ROM, Disk Basic, or DOS.

Address (HEX)	Comments
4015	Device type (01) Keyboard DCB
4016	LSB—Driver address (3E3H)
4017	MSB—Driver address
4018	Unused (0)
4019	Unused (0)
401A	Unused (0)
401B	"K"
401C	"I"
401D	Device type (07) Video DCB
401E	LSB—Driver address (458H)
401F	MSB—Driver address
4020	LSB—Cursor Position (3C00H)*
4021	MSB—Cursor Position *
4022	Cursor Character (0)*
4023	"D"
4024	"O"
4025	Device type (06) Printer DCB
4026	LSB—Driver address (58DH)
4027	MSB—Driver address
4028	Lines per page (67 or 43H)
4029	Line counter (0)*
402A	Unused (0)
402B	"P"
402C	"R"

Values in () are present on power-up (Level II).
Values with * change with output to device.

Table 1

Driver Utilization

For each device in the system, a device control block (DCB) is set up. The keyboard (*KI for keyboard input), video (*DO for display output), and printer (*PR for printer) DCBs are located at addresses 4015H–402CH (see Table 1). Each of these DCBs consists of: a 1-byte device type; a 2-byte driver address; 3 bytes that the driver uses to store data pertaining to that driver; and a 2-byte device ID (KI, DO, or PR in ASCII).

Device Type

The device type is used by a master I/O routine in ROM (at 3C2H) to determine whether the action requested is legal.

Here is a bit breakdown of the device type:

The Key Box

Model I or III
4K RAM
Basic, Assembly Language
Ed/Asm

A 50,000 word dictionary

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80 Microcomputing, 9/82

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Integrates into 7 different word processing programs, (SuperScripsit, Scripsit, Newscript, Lazy Writer, Electric Pencil, Copy Art, Superscript) You need only press a key and in moments, Electric Webster can actually be saving, proofing, correcting and hyphenating your text—all automatically. You can view words in context, or add them to your dictionary at the stroke of a key. If you think you know the correct spelling of a word, EW will check it for you before it makes the corrections. If you don't know, EW will look up the correct spelling for you, and display the dictionary. In as little as 30 seconds, Electric Webster can return you to your Word Processing program, with your text fully corrected and on your screen.

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LOW PRICES—Add features as you need them:
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Spelling Correction $59.99 — includes correction, dictionary lookup and 6 word processing integrations.
Grammatical Checking $49.99
Hyphenation $49.99

ACCLAIMED IN REVIEW AFTER REVIEW:

MICROPROOF (EW's predecessor):

"There is simply **no finer program** available . . ."
Creative Computing, March 1982

"This is a very useful product and should be obtained by anyone who uses a word processor." *80 Microcomputing*, August 1981

"The summary review of this program? **One word—Excellent.**"
Computronics, September 1981

AND NOW ELECTRIC WEBSTER:

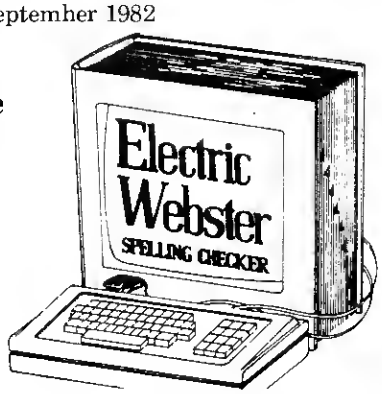
My spelling book is now gathering dust. Electric Webster not only checks spelling, displays words in context and corrects errors in the text, but it will also immediately take you to the right place in a 50,000 word dictionary so you can check the correct spelling for yourself."
Info World, August 1982

"In my opinion, **the perfect combination** is Correcting Electric Webster with the hyphenation and grammar add-ons. To my surprise, it fills every reasonable expectation. It is fast, easy to use and accurate."
Desktop Computing, December 1982

"Actually, Electric Webster is faster than its predecessor (Microproof). . . and spelling corrections are immediately verified against the dictionary before being accepted. . ."
Microcomputing, September 1982

"Electric Webster is the **Cadillac of vocabulary programs. . .** If I could only have one, it would be Electric Webster.
'80 Microcomputing, September 1982

The Ultimate PROOFING SYSTEM



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If bit 0 of the device is set, the device is used for input. If bit 1 is set, the device can be used for output. Bit 2 is unclear, possible uses could be: if set, to enable ability to output control byte to the driver or device or input status from them. The other bits are not used.

If you try an illegal function, ROM jumps to 4033H (Level II power-up), which usually consists of:

```
4033H   LD    A,0
4035H         RET
```

The video is used as an input device. The device type is 07; bit 0 is set. To test this, try the following code:

```
LD      DE,401DH    ;Point DE to video DCB
CALL    13H         ;Set input flag and
                    jump to master I/O
                    routine
```

The input byte will be in the A register and is the ASCII value of the character at the current cursor position on the video display.

Driver Address

The driver routine's address is stored in these 2 bytes in Z80 LSB/MSB format, with LSB followed by MSB. Turning on Level II puts the addresses of the standard drivers here.

Driver-used Bytes

While the keyboard driver at 3E3H uses none of these bytes, the video driver at 458H uses all three of these bytes as follows: 4020H and 4021H contain the address of the cursor position in screen memory (3C00H–3FFFH), and 4022H contains the cursor character (the character on the screen before the cursor (5FH) wrote over it). If 4022H equals zero, the cursor is not on.

The printer driver at 58DH uses two of these bytes as follows: 4028H contains the number of lines per page. 4029H contains the line number currently being printed.

"A driver can be located anywhere in memory."

Using the Drivers

To use a driver, call the driver address. Since most drivers don't save registers you might be using, save them first. Be sure to tell the driver what type of action is required (input, output, or control).

There are ROM routines that make this easier. First, point DE to the DCB of the desired device and call one of the

Project 1—Flashing Cursor

Intercept the keyboard driver by putting the address of your own driver in the keyboard driver address (4016H) in the *KI DCB (see Table 1). Whenever Basic, DOS, or any other program accesses the keyboard through 2BH, a jump is made to your driver. There you get the ad-

```
00100 ;*************************************************
00110 ;**                  FLASH/ASM                  **
00120 ;**        Flashing Cursor Program (A *KI DVR)  **
00130 ;**             Written by Jerry Lindsly        **
00140 ;**                1175 Shuler Avenue           **
00150 ;**               Hamilton, Ohio  45011         **
00160 ;*************************************************
00170 ;
00180 ;****   Define labels
00190 DELAY   EQU     0060H           ;ROM delay routine.
00200 KIDCB   EQU     4015H           ;Keyboard Device Control Block (*KI DCB).
00210 CURPOS  EQU     4020H           ;Cursor position.
00220 CURCHR  EQU     4022H           ;Cursor character.
00230 MAXMEM  EQU     0FFFFH          ;Highest RAM location in your machine.
00240 ;****   The following five lines if DOS:
00250 TOPMEM  EQU     4049H           ;Pointer to top of usable RAM (DOS).
00260 RETURN  EQU     402DH           ;Normal re-entry to DOS.
00270         ORG     MAXMEM-62-6     ;Put in high RAM (MAXMEM
00280                                 ;  minus length of program
00290                                 ;  minus DOS work area).
00300 ;****   The following four lines if Level II Basic:
00310 ;TOPMEM EQU     40B1H           ;Pointer to top of usable RAM (Basic).
00320 ;RETURN EQU     0072H           ;Normal re-entry to Basic.
00330 ;       ORG     MAXMEM-62       ;Put in high RAM (MAXMEM
00340                                 ;  minus length of program).
00350 ;****   Initialize
00360 START   PUSH    HL              ;Save for return to DOS.
00370         LD      HL,(KIDCB+1)    ;Get old DVR's address.
00380         LD      (KBSCAN+1),HL   ;Save for patch back to old DVR.
00390         LD      HL, BLINK       ;Get new DVR's address
00400         LD      (KIDCB+1),HL    ;Save DVR address in *KI DCB.
00410         DEC     HL              ;Point to one less than DVR.
00420         LD      (TOPMEM),HL     ;Save in pointer to top of usable RAM.
00430         LD      A,1CH           ;Get "Home Cursor" ctrl code.
00440         CALL    33H             ;Print it.
00450         LD      A,1FH           ;Get "Clear to End of Frame" ctrl code.
00460         CALL    33H             ;Print it (clear screen).
00470         POP     HL              ;Restore.
00480         JP      RETURN          ;Re-entry to Basic or DOS.
00490 ;****   The driver
00500 BLINK   LD      A,(CURCHR)      ;Get cursor character.
00510         OR      A               ;Test for zero.
00520         JR      Z,KBSCAN        ;Go if no cursor.
00530         LD      HL,(CURPOS)     ;Get cursor position.
00540         LD      A,(IX+3)        ;Get flag byte.
00550         XOR     1               ;Toggle flag and test.
00560         LD      (IX+3),A        ;Save new flag.
00570         LD      (HL),8FH        ;Display graphic block at cursor.
                                      MORE
00580         JR      Z,PAUSE         ;If flag=0, skip next instruction.
00590         LD      (HL),20H        ;Display blank at cursor.
00600 PAUSE   LD      BC,180H         ;Get delay count.
00610         CALL    DELAY           ;Delay 6 milliseconds (approx.).
00620 KBSCAN  JP      0               ;Patch to old *KI DVR (get key & return).
00630         END     START           ;Auto-start (execution address).
```

Program Listing 1

SUPER DIRECTORY

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following addresses:

- 13H-INPUT—Saves BC RP to stack and loads B with 01. (01 is the flag that prepares the driver for input.) Remember: bit 0 is set. A jump is made to the master DCB routine (3C2H).
- 1BH-OUTPUT—Saves BC RP to stack and loads B with 02 (02 is the flag that signals the driver for output; bit 1 is set). A jump is made to 3C2H.
- 23H-CONTROL—Saves BC RP to stack and loads B with 04 (04 is the flag that outputs control or inputs status from the driver). Bit 2 is set and a jump is made to 3C2H.

All of these routines jump to the following one:

- 3C2H-Master DCB routine—Registers are saved, and IX is pointed to the DCB. The C register is equal to output byte, and device type is compared to the desired function (B register) for legality. If the function is illegal, a jump is made to 4033H. HL is pointed to the driver, and a call is made to the driver. Upon return from the driver, the register contents are restored and you are returned to the calling program.

The following routines point DE to the DCB and jump to the usual input (13H) or output (1BH) routine:

- 2BH-keyboard input—DE is pointed to the *KI DCB and a jump is made to the input routine (13H).
- 33H-video output—DE is pointed to *DO DCB and a jump is made to the output routine (1BH).
- 3BH-printer output—DE is pointed to *PR DCB and a jump is made to the output routine (1BH).

Register Set-up to Call Routines

If you use an output driver to call these routines, place the byte to be output in the A register prior to calling 1BH, 33H, or 3BH. If you call 1BH, don't forget to place the address of the desired device's DCB in the DE RP; 33H and 3BH do this for you.

If an input driver is called, the A register contains the input byte after calling 13H or 2BH. If you call 13H, place the address of the desired device's DCB in the DE RP; 2BH does this for you.

If a control byte is to be output or a status byte is to be input from the driver, place the address of the desired device's DCB in the DE RP and the control byte in the A register prior to calling 23H. The status input byte is in the A register upon return.

dress of the cursor from the *DO DCB (see Table 1), and blink it off or on. Then jump to the old keyboard driver, the address of which is stored at 4016H prior to your putting the address of your driver there.

Program Listing 1 Line Functions

100–170	Program ID comments.
180–340	Define labels and origin.
190	Delay routine in ROM; load BC with delay count and CALL 60H (AF & BC are used and equal zero on return). The code at 60H looks like: 60H DEC BC ;Drop delay count. 61H LD A,B ;Get MSB. 62H OR C ;OR with LSB. 63H JR NZ,60H ;If both are not ;zero, do again. 64H RET ;Return back.
230	Set MAXMEM equal to the highest RAM location in your machine: 4K—4FFFH 16K—7FFFH 32K—0BFFFH 48K—0FFFFH
240–290	DOS only lines.
250	This pointer protects your program from actions of DOS.
300–340	Level II Basic only lines.
310	This pointer protects your program (like "MEMORY SIZE?" does) from the actions of Basic.
350–480	Initialize.
360	Start of program. Save HL (used on return to DOS).
370	Load HL with the address of the current *KI driver.
380	Save the old *KI DVR's address at KBSCAN + 1 so the jump instruction at that location jumps to the old DVR to return a key to the calling program.
390	Load HL with address of new *KI DVR.
400	Store in the *KI DCB's DVR address.
410	Point HL to one less than the driver and save
420	in the pointer to top of usable RAM (protect program).
430–460	Clear screen.
480	Return back to Basic or DOS.
490–620	The actual flashing cursor driver.
500	Load A with the cursor character from the *DO DCB.
510	Test it for zero. Zero means there is no cursor (instead of input, printing type action is being performed).
520	If no cursor, forget about making it flash and jump to the old *KI DVR.
530	Load HL with the address of the cursor from the *DO DCB.
540	On entry to a driver, IX points to the respective device's DCB; in this case, the *KI DCB. So load register A with flag byte stored at 4018H in the *KI DCB. Remember those three unused bytes? You're using one of them now as a flag byte.
550	Toggle flag. If A equaled zero, it now equals one, and vice versa. Z flag is set or reset depending on whether the result is zero or one, respectively.
560	Save the toggled flag back where you got it.
570	Store a graphics block at the cursor position (blink cursor on).
580	If the flag equaled zero after you toggled it, skip the next instruction and leave the cursor on.
590	Store a blank at the cursor position (blink cursor off).
600	Load BC with a 6-millisecond delay count.
610	Delay. This slows down the blinking and provides some key debounce.
620	Jump to the old *KI DVR. Get a key and return.
630	Auto-start. This is the execution address used by DOS to jump to the start of the program when it is loaded, and by Basic as the "/<ENTER>" address of the System command.

Register Set-up at Entrance to Drivers

Register A contains the function flag: 01 for input, 02 for output, or 04 for control status. Status flags are also set as follows: C flag is set for input, Z flag is set for output, and both reset for control/status.

B also contains the function flag, and C contains the byte to be output or the control byte. HL contains the address of the driver; this is useful for making your drivers relocatable. IX contains the address of the device's DCB and DE points to the DCB.

To return the input or status byte to the calling program, place it in the A register and return. ■

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Project 2—PRINT/LPRINT Output Directing

If you put the address of the video driver into the *PR DCB driver address, all output that normally goes to the printer is directed to the video.

Program Listing 2 lets you direct the output from PRINT or LPRINT to the video, the printer, or both at the same time.

Since this program is executed from Basic, DOS users must use an origin that is easily remembered (such as 65432) so that you can load the program in. Go to Basic, and type "SYSTEM <ENTER>", "/65432<ENTER>". Level II users can simply execute as usual; load the program in with the System command and type "/<ENTER>".

Program Listing 2

```
00100 ;**************************************************
00110 ;**                  DIRECT/ASM                  **
00120 ;**           Video/Printer Output Director      **
00130 ;**             Written by Jerry Lindsly         **
00140 ;**                1175 Shuler Avenue            **
00150 ;**              Hamilton, Ohio  45011           **
00160 ;**************************************************
00170 ;
00180 ;****   Define labels
00190 MAXMEM  EQU     0FFFFH          ;Highest RAM location in your machine.
00200 TOPMEM  EQU     40B1H           ;Pointer to top of usable RAM.
00210 BASIC   EQU     0072H           ;Re-entry to Basic.
00220 SNERR   EQU     1997H           ;Syntax error entry point.
00230 NAME    EQU     418FH           ;DOS reserved word vector.
00240 DODCB   EQU     401DH           ;Video DCB.
00250 PRDCB   EQU     4025H           ;Printer DCB.
00260 PRINT   EQU     0B2H            ;"PRINT" token.
00270 LPRINT  EQU     0AFH            ;"LPRINT" token.
00280 TO      EQU     0BDH            ;"TO" token.
00290 ;****   Initialize
00300         ORG     MAXMEM-115      ;Originate in high RAM.
00310 START   LD      HL,(DODCB+1)    ;Get video driver address.
00320         LD      (DODVR1+1),HL   ;Save for later use.
00330         LD      HL,(PRDCB+1)    ;Get printer driver address.
00340         LD      (PRDVR1+1),HL   ;Save.
00350         LD      HL,DIRECT       ;Point to output directing routine.
00360         LD      (NAME),HL       ;Save in NAME command vector.
00370         DEC     HL              ;Set "MEMORY SIZE?" to one
00380         LD      (TOPMEM),HL     ;  less than directing routine.
00390         JP      BASIC           ;Jump to Basic "READY" condition.
00400 ;****   Directing routine.
00410 DIRECT  CP      PRINT           ;Test for "PRINT" token.
00420         LD      DE,DODCB+1      ;Point to *DO DCB DVR address.
00430         JR      Z,DIR1          ;If "PRINT", skip over following code.
00440         CP      LPRINT          ;Test for "LPRINT" token.
00450         LD      DE,PRDCB+1      ;Point DE to *PR DCB DVR address.
00460         JP      NZ,SNERR        ;If neither "PRINT" nor "LPRINT", syntax
error.
00470 DIR1    RST     16              ;Skip over "PRINT" or "LPRINT" token.
00480         RST     8               ;Syntax check, make sure
00490         DEFB    TO              ;  "TO" token follows "PRINT" or
"LPRINT".
00500         CP      'V'             ;Test for 'V'.
00510         LD      BC,DODVR        ;Point BC to video driver.
00520         JR      Z,DIR2          ;If 'V', skip over following code.
00530         CP      'P'             ;Test for 'P'.
00540         LD      BC,PRDVR        ;Point BC to printer driver.
00550         JR      Z,DIR2          ;If 'P', skip over following code.
                                      MORE
00560         CP      'B'             ;Test for 'B'.
00570         LD      BC,BOTH         ;Point BC to DVR that outputs to both
video & printer.
00580         JP      NZ,SNERR        ;If neither 'V', 'P', nor 'B', syntax
error.
00590 DIR2    RST     16              ;Skip over 'V', 'P', or 'B'.
00600         EX      DE,HL           ;DE=Next Character Pointer, HL=DCB DVR
address.
00610         LD      (HL),C          ;Save LSB of selected driver address in
selected DCB.
00620         INC     HL              ;Bump to next address.
00630         LD      (HL),B          ;Save MSB.
00640         EX      DE,HL           ;HL=Next Character Pointer.
00650         RET                     ;Return to Basic.
00660 ;****   The drivers
00670 BOTH    PUSH    AF              ;Save flags.
00680         CALL    PRDVR           ;Print character on printer.
00690         POP     AF              ;Restore flags.
00700                                 ;Display character on video.
00710 DODVR   LD      IX,DODCB        ;Point IX to video DCB.
00720 DODVR1  JP      0               ;Display character (patch to video DVR.).
```

Listing 2 continues

Program Listing 2 Line Functions

100–170	Program ID remarks.
180–280	Define labels.
190	MAXMEM is used to tell the assembler where in memory to assemble the program. Set this equal to the highest free memory location in your machine: 4K—4FFFH 16K—7FFFH 32K—0BFFFH 48K—0FFFFH
200	TOPMEM (40B1H) is where the pointer to the highest available RAM location is stored. Used to protect the program from Basic. This is equivalent to the answer to the "MEMORY SIZE?" question.
210	Basic (72H) is a re-entry point to Basic.
220	SNERR (1997H) is the entry point of the syntax error routine.
230	NAME (418FH) is where control of the Basic interpreter is passed when the command "NAME" is encountered.
240	DODCB (401DH) is the address of the video device control block.
250	PRDCB (4025H) is the address of the printer DCB.
260	PRINT (0B2H) is the hex byte token where Basic stores the "PRINT" reserved word.
270	LPRINT (0AFH) is the token for the reserved word "LPRINT."
280	TO (0BDH) is the token for the reserved word "TO."
290–390	Initialization.
300	Originate machine code at MAXMEM minus 115 bytes.
310	Execution starts here. Load HL with address of the video driver.

Table continues

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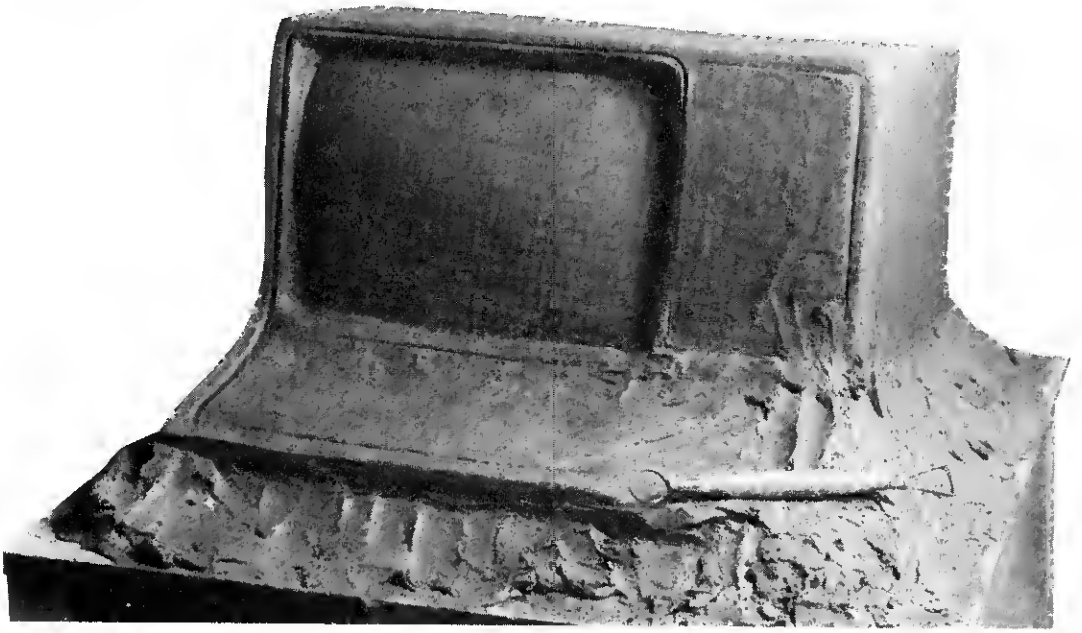

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To use the program, execute the following statement from command mode or from a Basic program:

NAME src TO dest
src = PRINT or LPRINT
dest = V, P, or B (V = Video, P = Printer, B = Both)

Example: NAME PRINT TO B directs all output normally going to the video to both the video and printer.

If you would rather use a Basic program instead of an Assembly listing, see Program Listing 3. Before running the program, load in all other drivers that you'll need.

The program relocates the routines to just below wherever "MEMORY SIZE?" is set. "MEMORY SIZE?" is reset below these routines.

Note the thorough error-checking included in the program; not only does it tell you what kind of error (HEX Syntax or Checksum), it in-

Continues

Table continued

320	Save, so you know where the video driver is.
330	Load HL with address of the printer driver.
340	Save this, too.
350	Load HL with address of your routine to change the drivers.
360	Save in the "NAME" command vector, so that when the NAME command is used in Basic it jumps to your routine.
370	Point HL to highest available RAM location to Basic.
380	Save in the "MEMORY SIZE?" pointer so Basic doesn't overwrite your routine.
390	Jump to Basic.
400–650	Routine to interpret syntax and change the drivers as selected. Upon entry to the routine, HL points to the encoded Basic line after the occurrence of the NAME command. Register A contains the first character following the NAME token.
410	Test to see if the character is the "PRINT" token.
420	If it is, you want DE pointing to the video DCB driver address.
430	If it is the "PRINT" token, skip the following processing.
440	Test to see if the character is the "LPRINT" token.
450	If it is, you want DE pointing to the printer DCB driver address.
460	If the character is neither "PRINT" nor "LPRINT", it must be a syntax error.
470	RST 16 is used to increment HL over the current character in the tokenized Basic program lines; skip over spaces, line feeds, etc., and retrieve the next character to the accumulator. The character is also tested for numeric. C is set if the character is in the range ASCII 0 (30H) to 9 (39H).
480	RST 18 makes a syntax check. If the next character (pointed to by HL) doesn't equal the byte following the RST 8 opcode, a jump is made to the syntax error routine (1997H). In this case, you want the next character to be the "TO" token.
490	"TO" token used with RST 8 above.
500	Test for V.
510	Load BC with the address of the video driver (stored earlier).
520	If V, skip over the following process so output goes to the video.
530	Test for P.
540	Load BC with the address of the printer driver.
550	If P, skip over the following process so output goes to the printer.
560	Test for B.
570	Load BC with the address of the routine to direct output to both video and printer.
580	If character is not V, P, or B, syntax error.
590	Increment HL over V, P, or B. At this point, DE points to the DCB driver address we want to change, video or printer. BC points to the address of the driver you want output to go to: video, printer, or both.
600	Point HL to the DCB driver address to change; DE contains the next character pointer to the Basic line.
610	Save LSB of the address of selected driver in the LSB of the selected driver address.
620	Point HL to MSB of the driver address.
630	Save MSB.
640	Restore next character pointer to HL (necessary to return to Basic properly).
650	Return back to Basic (continue processing Basic line and program).
660–900	The drivers.
670–700	Driver to direct output to both printer and video.
670	Save flags so that they are the same for both drivers.
680	Output character to printer.
690	Restore flags.
700	Since video driver immediately follows, there is no need to call it.
710–720	Video driver.
710	Point IX to video DCB. At entrance to a driver, IX is assumed to point to the DCB of that device. If, however, output is directed from the *PR DCB to the video driver, IX points to the *PR DCB, not the *DO DCB, as it should. This code corrects that.
720	Jump to the video driver. At initialization, the address of the actual *DO DVR was stored here at DODVR + 1.
730–900	Printer driver.
730	Save flags.
740–750	Transfer IX to HL.
760	Get LSB.
770	Test to see if output came from *PR DCB (4025H); if so, IX points to it. Otherwise, IX points to *DO DCB (401DH).
780	If output came from *PR DCB, skip the following filter code:
790–870	Filter code. Output coming from video DCB to the printer DVR may contain unneeded control codes. This code filters out all but carriage returns and line feeds.
880	Restore flags.
890	Point IX to printer DCB for same reasons IX is pointed to *DO DCB in line 710.
900	Jump to the printer driver. At initialization, the address of the actual printer driver is stored here at PRDVR + 1.
910	End of program; execution address.

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Continued

dicates in what data line the error occurred. This is accomplished by PEEKing a pointer in reserved RAM; this pointer is constantly updated by Basic and contains the line number of the last read data item. HEX Syntax error refers to an invalid hex character (those other than 0–9 or A–F). The last hex byte in each data line is the checksum for that line. If you get either error, compare the line to the listing.

Now you are familiar with DCBs and drivers. Experiment with what you have learned. Some information on using DOS-reserved words and syntax can also be picked up by studying Program Listing 2. ■

Listing 2 continued

```
00730 PRDVR   PUSH    AF              ;Save flags.
00740         PUSH    IX              ;IX points to DCB, so
00750         POP     HL              ;  transfer IX to HL.
00760         LD      A,L             ;Get LSB.
00770         CP      25H             ;Test to see if output came from *PR DCB
(4025H).
00780         JR      Z,PR1           ;If it did, skip the following filter
code.
00790         LD      A,C             ;Get character to be printed.
00800         CP      20H             ;Test for control codes.
00810         JR      NC,PR1          ;If not a control code, go ahead and
print it.
00820         CP      0DH             ;Test for carriage return.
00830         JR      Z,PR1           ;If carriage return, go ahead and print
it.
00840         CP      0AH             ;Test for line feed.
00850         JR      Z,PR1           ;If linefeed, go ahead and print it.
00860         POP     AF              ;All other controls don't print;
00870         RET                     ;  just restore flags and return.
00880 PR1     POP     AF              ;Restore flags.
00890         LD      IX,PRDCB        ;Point to printer DCB.
00900 PRDVR1  JP      0               ;Print character & return (patch to
printer DVR.).
00910         END     START           ;Auto-start.
```

```
0 CLS:CLEAR200:DEFINTG
10 PRINT"*****************************************************"
20 PRINT"**                    FLASH/BAS                    **"
30 PRINT"**          FLASHING CURSOR PROGRAM                **"
40 PRINT"**                      &                          **"
50 PRINT"**                   DIRECT/BAS                    **"
60 PRINT"**      VIDEO/PRINTER OUTPUT DIRECTOR              **"
70 PRINT"**          WRITTEN BY JERRY LINDSLY               **"
80 PRINT"**            1175 SHULER AVENUE                   **"
90 PRINT"**          HAMILTON, OHIO  45011                  **"
100 PRINT"*****************************************************"
200 PRINT@847,"(F) LASH, (D) IRECT, OR (B) OTH":GOSUB205
202 PRINT@847,"( ) LASH, (·) IRECT, OR ( ) OTH":GOSUB205:GOTO200
205 FORN=1TO25:A$=INKEY$
210 IFA$="F"THENZ=1:L=47ELSEIFA$="D"THENZ=2:L=112ELSEIFA$="B"THENZ
=3:L=159ELSENEXT:RETURN
220 X=PEEK(16561)+256*PEEK(16562)-L
230 CLS:PRINT"START ADDRESS =";X:PRINT"END ADDRESS =";X+L-1:PRINT:
PRINT:GOSUB500
240 POKE16411,G1:POKE16412,G2:POKE16419,Z:X=X-3:GOSUB500:POKE16561
,G1:POKE16562,G2
250 CLEAR200:DEFINTC-P:DEFSTRA,B,Z
260 X=PEEK(16411)+256*PEEK(16412):D=PEEK(16419):POKE16411,75:POKE1
6412,73:POKE16419,68
270 IFD AND 1 THENZ="FLASH" :GOSUB290
280 IFD AND 2 THENZ="DIRECT":GOSUB290
285 END
290 PRINT
300 READA:IFA<>ZTHEN300ELSES=X:PRINTZ;:Z1="END."+Z
310 READA:IFA=Z1THENS1=X:GOTO600ELSEQ=0
320 FORN=0TOINT(LEN(A)/3)-1:B=MID$(A,N*3+1,2):GOSUB400:GOSUB500
330 POKEG,H:Q=Q+H:X=X+1:PRINT".";:NEXT
340 B=RIGHT$(A,2):GOSUB400:Q=Q-INT(Q/256)*256
350 IFH=QTHEN310ELSEPRINT:PRINT"CHECKSUM";:GOTO430
400 B1=LEFT$(B,1):GOSUB410:H=H1*16:B1=RIGHT$(B,1):GOSUB410:H=H+H1:
RETURN
410 H1=ASC(B1)-48:IFH1>-1THENIFH1<10THENRETURNELSEH1=H1-7:IFH1>9AN
DH1<16RETURN
420 PRINT:PRINT"HEX (";B;") SYNTAX";
430 PRINT" ERROR IN DATA LINE";PEEK(16602)+256*PEEK(16603):END
500 G=X+(X>32767)*65536:G2=X/256:G1=X-G2*256:RETURN
600 READM:IFM<>-1THENX=S+M:GOSUB500:GA=G:P=PEEK(G):X=X+1:GOSUB500:
GB=G:X=P+256*PEEK(G)+S:GOSUB500:POKEGA,G1:POKEGB,G2:GOTO600
610 X=S:GOSUB500:POKE16782,195:POKE16783,G1:POKE16784,G2
620 NAME:PRINT:PRINTZ;" - ACTIVATED":X=S1:RETURN
1000 DATA "FLASH"
1010 DATA "E5 2A 16 40 22 2D 00 21 0F 00 22 16 40 E1 C9 3A 40"
1020 DATA "22 40 B7 28 17 2A 20 40 DD 7E 03 EE 01 DD 77 03 86"
1030 DATA "36 8F 28 02 36 20 01 80 01 CD 60 00 C3 00 00 B7"
1040 DATA "END.FLASH", 5, 8, -1
2000 DATA "DIRECT"
2010 DATA "E5 2A 1E 40 22 4E 00 2A 26 40 22 6E 00 21 15 00 33"
2020 DATA "22 8F 41 E1 C9 FE B2 11 1E 40 28 08 FE AF 11 26 CF"
2030 DATA "40 C2 97 19 D7 CF BD FE 56 01 49 00 28 0F FE 50 38"
2040 DATA "01 50 00 28 08 FE 42 01 44 00 C2 97 19 D7 EB 71 AB"
2050 DATA "23 70 EB C9 F5 CD 50 00 F1 DD 21 1D 40 C3 00 00 68"
2060 DATA "F5 DD E5 E1 7D FE 25 28 0F 79 FE 20 30 0A FE 0D 4B"
2070 DATA "28 06 FE 0A 28 02 F1 C9 F1 DD 21 25 40 C3 00 00 31"
2080 DATA "END.DIRECT", 5, 11, 14, 42, 49, 56, 70, -1
```

Program Listing 3

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The scenario is that you are the King of Jerusalem and have to rule your Kingdom from 1169 to 1177. Your ultimate aim is to prevent any incursions by the invading Saracens. You have a total of forty-eight fortresses, all interconnected by caravan routes. The program will pick these off one by one, unless you can defeat the Saracen army in the field, by gathering together an army for yourself from the various garrisons.

Each year consists of six (bi-monthly) moves. At the end of each year (at play rating 6), you will find a new Saracen army moves into the Kingdom from enemy territory. All Saracen armies that stay in the field for a year are reduced by desertions.

The program itself has an artificial intelligence, in as much as the Saracens attempt to seige and take castles and fortresses that they have not previously moved to. In this way a Saracen army that has been seiging for a few years may be reinforced by a new army, which may be sufficient troops to affect the taking of the fortress.

However, your troubles do not stop there! You have to provide food for garrisons and your assembling army. If you find a garrison is under seige, the only way to give them food is to send a caravan, which costs money!

The program is menu-orientated and a map is supplied for both the Northern area and the Southern. The graphics are good, and both Crusader lines and Saracen lines are also displayed, again with an appropriate map. The caravans, of course, are used to transport food from town to town and when this option in the menu is selected then the 5 available caravans are displayed on the screen. You then have four options, to attach or detach food or horses, and to raise or move caravans.

EMPEROR (Mod I/III Disk **$24.95** Tape **$19.95**)

Occasionally a game comes along which is of such immensity that it is almost impossible to describe. Such a game is "Emperor". It is entirely a game of strategy, played on a graphic map of the Roman Empire as it was in the first four centuries A.D. The player takes the part of the Emperor and he must pit his wits and forces against invading barbarians, rebellious provincials and treacherous Roman Generals. Even the Plebs of Rome will have to be placated with bread and circuses if the Emperor is to keep his head and throne. If he can last our for the first eight years of the game, he is judged on the state of the Empire at the end of that time. There are three levels of play. Depending upon his choice, the Emperor has to guide the Empire through the first, third and fourth centuries. To win in the first century he must expand the Empire by two provinces, in the third he must maintain his Empire intact and in the fourth he must lose not more than two Provinces. For each Province the player is given three items of information, the number of loyal Legions, the number of revolting Legions and the number of Barbarian Invaders or Local Rebels. During play Legions must be raised, taxes inflicted and troops moved. The choice of Generals can be very critical–some are loyal and good fighters, some are neither. Battles must be fought and invasions repelled. All the while the citizens in Rome must be kept happy and —you must keep an eye on those Barbarians in Britannia!

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Apple Core Emulator

by Gary Grout

Now Model I and Model III users can have the best of both worlds. With this emulator, your TRS-80 writes and runs Apple II software.

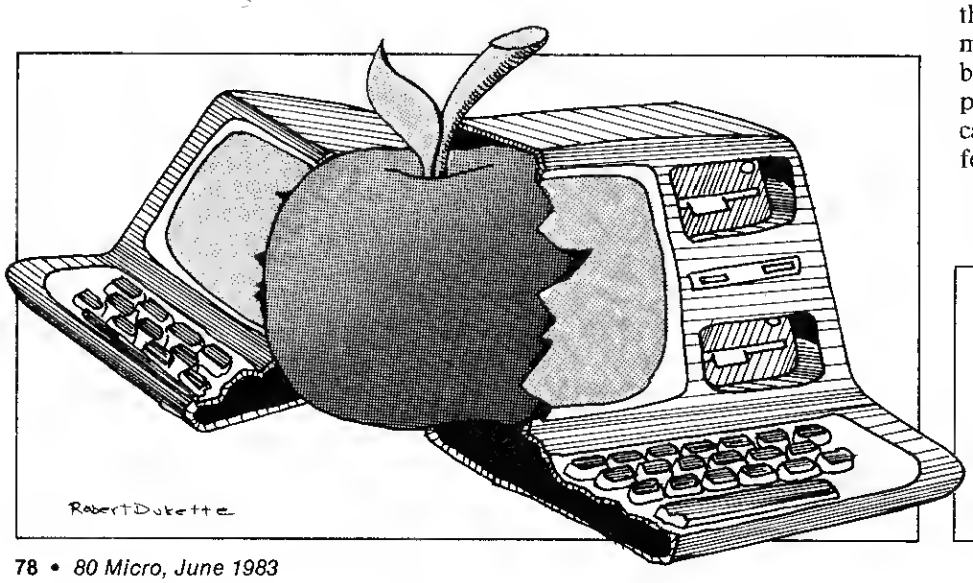
The heart of the Apple II computer is the 6502 microprocessor. The Apple's popularity can be attributed to its simple program and interface requirements and is manifest by the wide variety of available software.

TRS-80 owners who want to access some of that software don't have to spend $1,500 to buy an Apple. A less expensive solution is the Apple II emulator program provided here.

An emulator is a software program that mimics the way a particular piece of hardware (like a microprocessor) operates. It performs the same functions and produces the same results as that hardware.

I call my 6502 emulator the Apple Core Emulator. Not only can it run Apple-compatible programs, it creates them as well. The emulator converts Assembly-language code for the TRS-80 Z80 microprocessor into 6502 machine code.

Since emulation is by nature slow, there are limitations to the emulator's processing speed. It takes several Z80 instructions to duplicate a single 6502 instruction, so it's doubtful that anyone would write a commercial machine-code program for the 6502 to run on a Z80. But you can produce 6502 code with a TRS-80 that runs on a 6502 microprocessor.



Going to the Code

The Apple Core Emulator interprets 6502 code one instruction at a time and substitutes Z80 routines for each.

The 6502 register structure and its addressing modes are quite different from those of the Z80. The Z80 has 14 registers, eight of which make up a rarely used alternate register set. The emulator uses this alternate register set to keep track of 6502 code.

The 6502 has only three 8-bit registers, a stack pointer, program counter, and flag register. The working registers are named A, X, and Y. The program counter is referred to as PC, the stack as S, and the flag register as P (for phlag).

Although the 6502 has fewer registers, it's more versatile. Microprocessors use addressing modes to access main memory or other registers. One difference between the 6502 and the Z80 is that the 6502 uses paging to address memory: it handles memory in 256-byte blocks called pages. The 6502 has a zero page, the first 256 bytes of memory, called frequently when using the different addressing modes.

The Key Box

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The 6502's nine different addressing modes let you manipulate data in many different ways. The nine modes are: immediate, absolute, direct, relative, indexed, pre-indexed, post-indexed, indirect, and implied.

Coming to Terms

Explaining the addressing modes is difficult. My analogy of a train delivering freight should help you understand each mode.

Consider the CPU as a train traveling down a track. The track represents a program with each railroad tie a byte. The program is a continuous track of memory from byte zero to FFFFH. The engine is a program counter. It travels down the line passing each instruction byte in a sequence determined by the track. The train cars are registers A, X, Y, and P. They are loaded and unloaded as they progress through the program.

Loading and unloading train cars is analogous to using the CPU addressing modes. The program instructions or opcodes (ties) encountered by the program counter (engine) one at a time determine what is loaded, how it is loaded, and which register (car) to load.

"Consider the CPU as a train traveling down a track."

The following descriptions of the addressing modes provide a technical explanation, an example instruction, and an explanation using the train analogy.

In the implied mode, the opcode contains the names of the registers it will use. A mnemonic example is TXA. This instruction transfers the contents of the X register to the contents of the A register.

On the railroad, the program counter engine passes over the instruction on the track. TXA names the cars to load and unload; it tells the train to move the cargo from car X to car A.

Immediate addressing uses the next

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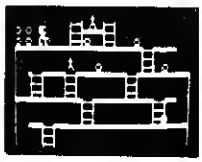

LIBERATOR by John Crane

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With your eyes glued to the screen and your fingers wrapped around the controls, move cautiously through the treacherous industrial park on a most dangerous mission. You must locate and rescue four lovely young girls from their monsterous capture. Ahh, but there's a catch! They've been captured by a 2000 pound, seven foot tall, mechanical robot gone mad. Sound easy? Just wait until you see the surprises we've got instore for you! 1982's most popular arcade game, Donkey Kong™, comes to life on your TRS-80 screen through the magic of John Cranes LIBERATOR! And if you thought Donkey Kong was fun, wait until you experience LIBERATOR's five seperate screens (more than the arcade version) each utilizing the best sound and graphics possible!
Model I/III.

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CLASH By Bill Dunlevy

Once again, one of the markets most creative programers, creator of Assault, Jovian, and the ever famous Cyborg, brings to the industry another smash hit! Yes, Bill Dunlevy has created CLASH, a fantastic new arcade simulation!
Mounted upon your great white winged stallion, prepare yourself for a clash within the arena. This day, you will be competeing against famous riders from all over the planet. As the tournament begins, their is a frenzy of flapping wings and bucking horses, but finally all riders are airborne and the contest has begun. With a firm grasp on the reins, manuever your horse above the others and then descend upon them. You must dismount the other riders, before their skill prevails and they dismount you.
Be warned, CLASH is for those riders of skill and reactions! Even one second of carelessness can prove fatal. But for those who love a challenge and an adventure, CLASH, with its multi-levels of play, will definitely become a favorite! Model I/II

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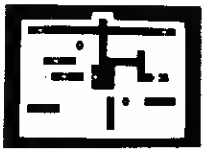

DIG OUT by John Crane

Uh oh! The wackiest game to ever hit an arcade is now invading your computer! Dig Out, that crazy game of dirt and rock will turn your reactions inside out.
As the game begins, you'll find yourself amidst tons of rock and earth. You must dig your way through the surrounding tunnels and hunt down the deadly monsters. But watch out!!! As the hunter, you might just become the hunted. The monsters are strangely powertul, their touch can destroy and their eggs can obliterate. Besides all this, the underground is their natural habitat. With a mere thought, they can move through tons of rock and appear before you. So, you better be quick and your reactions better be good!!!
DIG-OUT is truly another COMPUTER SHACK classic. In each of its fifteen different levels, DIG-OUT combines the best sound, fantastic graphics, and above all, exciting action for a game that surpasses even the original. Model I/III

Tape..... **$19.95** Disk..... **$21.95**

ASSAULT by Dunlevy & Froyer

Strap yourself into the dimly lit ATV (All Terrain Transport), check the motor, the laser's, and visibility, Now prepare yourself for an underground trip that you won't soon forget... If you live! After weeks of exploring and mining, you've accumulated quite a tidey sum of gold. But just as you thought the adventure to be over, you stumble upon a part of the mountain that is soon to become your battle ground, if not your grave. These wide open caverns are inhabited by strange creatures set upon stealing your gold and maybe even your life. You can battle them in your laser equipped ATV, but beware! Along the walls grow rather harmless looking mushrooms, that is until you've touched one. But all of this is childs play compared to battling NODRID, the emperor spider of this hellish place. His bloodthirsty fangs will make short work of any unwary adventurer, but you will not find him such an easy prey! Model I/III

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byte the program counter points to as data. For example, LDX 2 is an instruction that loads the X register with 2.

As the PC (program counter) engine passes over an immediate instruction, the engineer is informed that the next number he comes upon is something to be loaded onto or unloaded from the train. As the program counter travels over LDX of the example, it is told that the next number (2) should be picked up and placed in the X car.

Absolute addressing uses the next 2 bytes the program counter points to as an address for data in memory. STY $FE00 is a store opcode that stores the Y register at location FE00H.

As the engine travels over an absolute instruction, the engineer is informed that the next two numbers on the track specify the station where cargo can be picked up or left. As the PC engine encounters the absolute STY instruction, it takes the next 2 bytes on the track (FE00H) as the name of the station where car Y is to be unloaded.

Direct addressing uses the byte encountered by the program counter as an address for a byte in the first page (256 bytes) of memory. This is referred to as zero page addressing; the data is a byte in zero page. The STY 2 instruction stores the contents of the Y register in the zero page location 0002H.

As the train comes upon a direct instruction, the engineer learns that the next byte is the number of a warehouse at Central Station (page zero) where he is to transfer cargo. In this instance, the cargo is moved from car Y to warehouse 2 in Central Station.

"Indexed addressing uses a base address and adds the value in the X or Y register."

Relative addressing uses the next byte ahead of the program counter as an offset added to the program counter, and makes the program branch to some other point of execution.

If the zero flag is set, BEQ 12, the Branch Equal instruction, adds 12 to the data in the program counter. This instruction branches 128 bytes back or 127 bytes forward.

The instruction tells the engineer that a switch may have been thrown and that the distance to the new destination is the next number under the engine. The instruction, BEQ 12, says that if the flag car contains an equals sign, then it should take the next siding and rejoin the main line 12 bytes down the track.

Indexed addressing uses a base address and adds the value in the X or Y register to it.

The instruction LDA $3C08,X adds the value in the X register to 3C08H and uses the result as the address of a data byte to be loaded into the A register.

When the train encounters an indexed instruction, the engineer is told the next station at which he is to stop. He is also informed that either the X or Y car has information as to which warehouse to use for transfer. With LDA $3C08,X, the train stops at station 3C08H and adds the number in X to 3C08H. It then takes the resulting warehouse number, goes there, and then loads that cargo into car A.

Pre-indexed addressing adds the X

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register to the next byte in the program. The result is used to point to a 2-byte address in the zero page which then points somewhere else.

CMP (05,X) is the compare operation. It adds the value in X to 0005H, goes to that location in zero page, retrieves the address stored there, and uses it to fetch a data byte from memory to compare with register A.

At this point, the train analogy begins to read like a spy novel.

The engineer receives a message that the next byte the train passes over is the first half of a warehouse number at Central Station (zero page). The second half of the number is in the X car. The two numbers must be added together to get the complete warehouse number. In this warehouse is a note telling the real location of the cargo. In this example, the data in 0005H is added to the cargo number in the X car, resulting in a warehouse number. That warehouse is opened and the shipment address is found. The material at the shipping address is compared to the contents of car A.

Post-indexed addressing takes the next byte in the program as an address in zero page. It uses 2 bytes located there plus the contents of the Y register as a pointer to some other location in memory.

The STA (05),Y instruction adds Y to the 2-byte address in zero page locations 5 and 6. The result is used as the address for storing the data byte in A register.

The engineer receives the message that the next byte is a warehouse number in Central Station. A note in the warehouse holds an address that, when added to the number in the Y car, tells where the shipment is stored. In the example, warehouse 5 is opened and the number in car Y is added to the address. This gives the location of the warehouse in which to store the contents of car A.

The indirect mode uses the next 2 bytes of the program to point to some other locations. JMP ($4035), the Jump instruction, takes an address from location 4035H and jumps to it.

The engineer receives word that the location of the next shipment is waiting at the next station, 4035H. There he gets a note specifying another location and proceeds there.

Instruction Sets on a Parallel Track

To compare the Z80 and 6502 instruction set, examine Fig. 1. Notice that, although the mnemonics are different, many of the 6502 instructions parallel the Z80 instruction set. All but three 6502 instructions have a corresponding Z80 instruction. The three

```
ADC     A+M+C-->A       ADD WITH CARRY
ANC     A AND M-->A     LOGICAL AND
ASL     C<-7XXXXXX0     ARITHMETIC SHIFT LEFT
BCC     BRANCH C=0      BRANCH CARRY CLEAR
BCS     BRANCH C=1      BRANCH CARRY SET
BEQ     BRANCH Z=1      BRANCH EQUAL
BIT     A AND M         COMPARE BITS WITH MEMORY
BMI     BRANCH N=1      BRANCH MINUS
BNE     BRANCH Z=0      BRANCH NOT EQUAL
BPL     BRANCH N=0      BRANCH PLUS
BRK                     BREAK
BVC     BRANCH V=0      BRANCH OVERFLOW CLEAR
BVS     BRANCH V=1      BRANCH OVERFLOW SET
CLC     0-->C           CLEAR CARRY
CLD     0-->D           CLEAR DECIMAL
CLI     0-->I           CLEAR INTERRUPT
CLV     0-->V           CLEAR OVERFLOW
CMP     A-M             COMPARE ACCUMULATOR
CPX     X-M             COMPARE X REGISTER
CPY     Y-M             COMPARE Y REGISTER
DEC     M-1-->M         DECREMENT
DEX     X-1-->X         DECREMENT X REGISTER
DEY     Y-1-->Y         DECREMENT Y REGISTER
EOR     A XOR M-->A     EXCLUSIVE OR
INC     M+1-->M         INCREMENT
INX     X+1-->X         INCREMENT X REGISTER
INY     Y+1-->Y         INCREMENT Y REGISTER
JMP     PC+M-->PC       JUMP
JSR     PC->S ADDR->PC  JUMP TO SUBROUTINE
LDA     M-->A           LOAD ACCUMULATOR
LDX     M-->X           LOAD X REGISTER
LDY     M-->Y           LOAD Y REGISTER
LSR     0->7XXXXXX0->C  LOGICAL SHIFT RIGHT
NOP                     NO OPERATION
ORA     A OR M-->A      OR ACCUMULATOR
PHA     A-->S S=S-1     PUSH ACCUMULATOR
PHP     P-->S S=S-1     PUSH PROCESSOR FLAGS
PLA     S-->A  S=S+1    PULL ACCUMULATOR
PLP     S-->P S=S+1     PULL PROCESSOR FLAGS
ROL     C<-7XXXXXX0<-C  ROTATE LEFT
ROR     C->7XXXXXX0->C  ROTATE RICHT
RTI                     RETURN FROM INTERRUPT
RTS     S->PC           RETURN FROM SUBROUTINE
SBC     A-M-C-->A       SUBTRACT WITH BORROW
SEC     1-->C           SET CARRY
SED     1-->D           SET DECIMAL
SEI     1-->I           SET INTERRUPT
STA     A-->M           STORE ACCUMULATOR
STX     X-->M           STORE X REGISTER
STY     Y-->M           STORE Y REGISTER
TAX     A-->X           TRANSFER ACCUMULATOR TO X REGISTER
TAY     A-->Y           TRANSFER ACCUMULATOR TO Y REGISTER
TSX     S-->X           TRANSFER STACK INTO X REGISTER
TXA     X-->A           TRANSFER X REGISTER TO ACCUMULATOR
TXS     X-->S           TRANSFER X REGISTER TO STACK
TYA     Y-->A           TRANSFER Y REGISTER TO ACCUMULATOR
(M  DENOTES MEMORY)
```

Figure 1

6502		Z80
A	=	A'
P	=	F'
Y	=	B'
X	=	C'
PC	=	IX
S	=	HL'

Figure 2

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different instructions are Break, Return from Interrupt, and No Operation. The similarity in instruction sets is encouraging to the Z80 programmer learning about the 6502. The major task, however, is to gain an understanding of how the nine addressing modes come into play while using these instructions.

I said earlier that the emulator uses the Z80's alternate register set to simulate most of the working registers of the 6502.

In Fig. 2 the accumulator and flag register of the 6502 are emulated by the AF' (AF prime) Z80 registers. The 6502's Y and X registers use the Z80 B' and C', respectively. The Z80 HL' acts as the 6502 stack pointer, and the Z80 IX performs the duties of the program counter.

Any reference to zero page is automatically directed to that section of memory. The index register IY is also initialized to point to 6E00H and need not be altered by the operator.

Another difference between the 6502 and the Z80 is in the flag bit positioning. Viewed from Debug, the normal 6502 flag register would appear as:

N	V	*	B	D	I	Z	C
7	6	5	4	3	2	1	0 bit

N	Negative	1 = neg
V	Overflow	1 = true
*	Not used	
B	Break	break command
D	Decimal Mode	1 = true
I	Interrupt	1 = disable
Z	Zero	1 = result zero
C	Carry	1 = true

The Z80 flags are:

S	Z	*	H	*	V	N	C
7	6	5	4	3	2	1	0 bit

S	Sign
Z	Zero
*	Not used
H	Half carry
V	Overflow
N	Add/subtract
C	Carry

The emulator preserves the Z80 bit order to prevent errors in interpreting the flags. The decimal flag is not displayed although the decimal mode of the 6502 is simulated. Break and interrupt are not used since the emulator is only suited for applications where breaking and interrupting the program are not needed. Other differences, such as the clearing and setting of the carry during addition and subtraction, are handled by the instruction subroutines.

The algorithm to perform 6502 code on the Z80 begins with an instruction to fetch the first 6502 operation code. This instruction is compared with a table for a match. This table holds all the addresses for the Z80 routines that simulate 6502 instructions. It consists of an instruction set opcode byte followed by the starting address of the routine to simulate the instruction.

When a 6502 instruction is matched to the Z80 routine, the program branches to that routine and the instruction is executed. The program then checks for single stepping or a break point. If these conditions don't exist, the second instruction is performed.

The subroutines that simulate the addressing modes of the 6502 are commonly used by all instructions. These addressing routines are found on lines 100–880 in the emulator. (See the Program Listing.) The subroutines that perform an instruction begin with line 880 and end with 7250.

The opcode labels are essentially the names of each instruction with a number before the last letter. An ADC instruction is labeled in the listing as AD1C. Labels that provide loops or location jump addresses are named some form of Go, Down, or Here, usually with a number.

The master routine that calls all other subroutines, searches tables, and checks for single stepping and break points falls on lines 10330–10720. From "Start," on line 10350, to "Loop," on line 10400, the HL register is saved, the next program instruction is fetched, and the address of the instruction table is loaded into HL.

The table search is performed from lines 10400–10500. From lines 10500–10570, the address of the subroutine that simulates the instruction is loaded into the 2 memory bytes behind the byte labeled "Inst." When Inst is read, the program counter calls the subroutine and then restores HL to check for single stepping. If no single stepping is required, IX is compared to HL for a break point and the program branches based on the result of that comparison.

Running Two at a Time

The Apple Core Emulator is run while in Debug. To begin the program, load the emulator with the DOS command Load and then enter Debug. Set the PC (program counter) register to the beginning of the emulating program (8000H). Load HL with a break-

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point address of the 6502 code or, if single stepping is desired, with 0000. Initialize the HL' register to 6FFFH for the 6502 stack.

To run a 6502 program, load the starting address of the 6502 program into the IX register. To single step through the 6502 program execution, load HL with 0000 and press the C key twice for every instruction you wish to execute. To run the program in its entirety, load the address of the program's end into the HL register and type C. The emulator program returns when that address is reached.

Notes on Debug

The Debug utility that accompanies NEWDOS80 lets you clear the screen before you execute the machine code by pressing clear prior to typing the G command. TRSDOS Debug for the Model I does not support that feature, but it can be simulated by inserting the following line into the Assembly listing. The line should be numbered 10325 and labeled Begin.

```
CD C9 01   10325   BEGIN   CALL   01C9H
;CLEARS   SCREEN
```

Delete the Begin label from line 10330. Then press C three times to execute a single 6502 instruction. When single-stepping, press the C key once to clear the screen, once to execute the code, and once to return to the beginning of the emulator.

In the Model I Debug, you can alter Debug while it is in memory; Model III users can't. Because of this, you can rename the alternate registers to match

```
                    100            .OR     $E000
E000    A9 41       110            LDA     #$41     ;HEX A
E002    A0 00       120            LDY     #$0
E004    99 00 3C    130    LOOP    STA     $3C00,Y
E007    C8          140            INY
E009    F0 03       150            BEQ     DONE
E00A    4C 04 E0    160            JP      LOOP
E00D    00          170    DONE    .BYTE   $00
                    180            .END
```

Figure 3

Figure 4

```
E000 A0 00       100    BEGIN   LDY     0
E002 AD 01 38    110            LDA     ROW1
E005 20 3B E0    120            JSR     TEST
E008 A0 08       130            LDY     8
E00A AD 02 38    140            LDA     ROW2
E00D 20 3B E0    140            JSR     TEST
E010 A0 10       150            LDY     16
E012 AD 04 38    160            LDA     ROW3
E015 20 3B E0    170            JSR     TEST
E018 A0 18       180            LDY     24
E01A AD 08 38    190            LDA     ROW4
E01D 20 3B E0    200            JSR     TEST
E020 A0 20       210            LDY     32
E022 AD 10 38    220            LDA     ROW5
E025 20 3B E0    230            JSR     TEST
E028 A0 28       240            LDY     40
E02A AD 20 38    250            LDA     ROW6
E02D 20 3B E0    260            JSR     TEST
E030 A0 30       270            LDY     48
E032 AD 40 38    280            LDA     ROW7
E035 20 3B E0    290            JSR     TEST
E038 4C 00 E0    300            JMP     BEGIN
E03B D0 01       310    TEST    BNE     DISP
E03D 60          320            RTS
E03E 18          330    DISP    CLC
E03F A2 00       340            LDX     0
E041 6A          350    DISP1   ROR
E042 E8          360            INX
E043 90 FC       370            BCC     DISP1
```

Figure 4 continues

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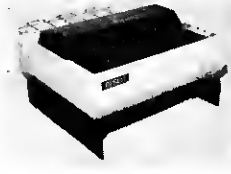

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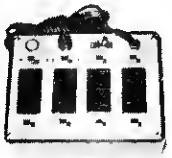

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Figure 4 continued

```
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E046 98          390              TYA
E047 86 03       400              STX     PTR3
E049 65 03       410              ADC     PTR3
E04B A8          420              BCC     DISP1
E045 18          380              CLC
E046 98          390              TYA
E047 86 03       400              STX     PTR3
E049 65 03       410              ADC     PTR3
E04B A8          420              TAY
E04C AD 80 38    430              LDA     SHIFT
E04F F0 05       440              BEQ     DOWN
E051 18          450              CLC
E052 98          460              TYA
E053 69 17       470              ADC     23
E055 A8          480              TAY
E056 B9 60 E0    490     DOWN     LDA     LETTER-1,Y
E059 A4 02       500              LDY     PRT1
E05B 99 00 3C    510              STA     SCREEN,Y
E05E E6 02       520              INC     PTR1
E060 60          530              RTS
E061 40          540     LETTER   .BYT    '@ABCDEFG'
E062 41          550
E063 42          560
E064 43          570
E065 44          580
E066 45          590
E067 46          600
E068 47          610
E069 48          620              .BYT    'HIJKLMNO'
E06A 49          630
E06B 4A          640
E06C 4B          650
E06E 4C          660
E06F 4D          670
E070 4E          680
E071 4F          690
E072 50          700              .BYT    'PQRSTUVW'
E073 51          710
E074 52          720
E075 53          730
E076 54          740
E077 55          750
E078 56          760
E079 57          770
E07A 58          780              .BYT    'XYZ'
E07B 59          790
E07C 5A          800
E07D 00 00 00    810              .BYT    $00,00,00,00,00
E080 00 00       820
E082 30          830              .BYT    '01234567'
E083 31          840
E084 32          850
E085 33          860
E086 34          870
E087 35          880
E088 36          890
E089 37          900
E08A 38          910              .BYT    '89:;,-./'
E08B 39          920
E08C 3A          930
E08D 3B          940
E08E 2C          950
E08F 2D          960
E090 2E          970
E091 2F          980
E092 0D          990              .BYT    $0D,$00,$00
E093 00          1000
E094 00          1010
E095 5B          1020             .BYT    $5B,$5C,$5D,$5E,$20
E096 5C          1030
E097 5D          1040
E098 5E          1050
E099 20          1060
E09A 21          1070             .BYT    '!"#$%&''
E09B 22          1080
E09C 23          1090
```

Figure 4 continues

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6502 notation. Memory from 4F61H–4F70H holds the names of the registers displayed by Debug. Modify those bytes to display the 6502 register names. (Caution: you must then refer to those registers using the 6502 names, not the alternate register-set names.)

If you rename BC' as YX', you must type RYX',xxxxh(enter) to change the contents of YX'.

Debugging

Experiment with the two sample programs in Figs. 3 and 4. The first program fills the screen with 250 A's. It's a good program to use while assembling and debugging the Apple Core Emulator. The second program is a keyboard scan that displays a character on the screen when a key is pressed. Assembling these 6502 programs enables you to get to know 6502 opcode.

"The emulator's goal is to acquaint you with the operation of the 6502."

When you debug the emulator, single-step one instruction in all of its addressing modes. If the addressing modes are working correctly, it is easier to pinpoint the subroutines that are assembled with errors.

Run the sample programs by entering the hex code into memory. You will immediately realize one drawback of an emulator: Because it interprets 6502 code, its execution is slow, just as Basic is slow when compared to an Assembly-language program.

However, the emulator's goal is to acquaint you with the operation of the 6502, not to simulate real-time arcade games. If you have software to convert to the 6502, the emulator gives you a head start on the task.

The 6502, together with a variety of support integrated circuits, simplified microcomputer construction. Today you can find 6502 microprocessors used in many popular computers. So if you're looking to expand your understanding of today's microcomputers, a few hours emulating the 6502 will be time well spent. ■

Gary Grout can be reached at 26324 Edgewater Blvd. NW, Poulsbo, WA 98370.

Figure 4 continued

```
E09D 24          1100
E09E 25          1110
E09F 26          1120
E0A0 27          1130
E0A1 28          1140              .BYT     '()*+<=>?'
E0A2 29          1150
E0A3 2A          1160
E0A4 2B          1170
E0A5 3C          1180
E0A6 3D          1190
E0A7 3E          1200
E0A8 3F          1210
                 1220     SCREEN   .EQ      $3C00
                 1230     PTR3     .EQ      $03
                 1240     PTR1     .EQ      $01
                 1250     ROW1     .EQ      $3801
                 1260     ROW2     .EQ      $3802
                 1270     ROW3     .EQ      $3804
                 1280     ROW4     .EQ      $3808
                 1290     ROW5     .EQ      $3810
                 1300     ROW6     .EQ      $3820
                 1310     ROW7     .EQ      $3840
                 1320     SHIFT    .EQ      $3880
                 1330              .END
```

Program Listing

```
00100     ORG     7000H
00110 IM        LD      A,(IX)          ; IMMEDIATE MODE ROUTINE
00120   INC     IX
00130   RET
00140 ABS       LD      L,(IX)          ;ABSOLUTE MODE ROUTINE
00150   INC     IX
00160   LD      H,(IX)
00170   INC     IX
00180   RET
00190 ZPAGE     LD      C,(IX)          ;ZERO PAGE MODE ROUTINE
00200   INC     IX
00210   LD      IY,ZEROP
00220   LD      B,0
00230   ADD     IY,BC
00240   PUSH    IY
00250   POP     HL
00260   RET
00270 HERE      LD      IY,ZEROP
00280   LD      B,0
00290   ADD     IY,BC
00300   LD      L,(IY)
00310   INC     IY
00320   LD      H,(IY)
00330   RET
00340 INDX      LD      A,(IX)          ;INDEX INDIRECT X MODE
00350   INC     IX
00360   CALL    ADX
00370   LD      C,A
00380   JP      HERE
00390 INDY      LD      A,(IX)          ;INDEX INDIRECT Y MODE
00400   INC     IX
00410   LD      C,A
00420   CALL    HERE
00430   LD      A,0
00440   CALL    ADY
00450   LD      C,A
00460   LD      B,0
00470   ADD     HL,BC
00480   RET
00490 ADX       EXX                     ;ADD X REG TO A ROUTINE
00500   PUSH    BC
00510   EXX
00520   POP     BC
00530   ADD     A,C
00540   RET
00550 ADY       EXX                     ;ADD Y REG. TO A ROUTINE
00560   PUSH    BC
00570   EXX
00580   POP     BC
00590   ADD     A,B
00600   RET
00610 ZPAGEX    LD      A,(IX)          ;ZERO PAGE INDEXED X MODE
00620   INC     IX
00630   CALL    ADX
```

Listing continues

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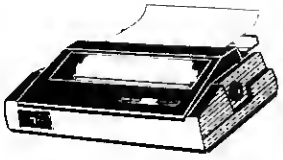

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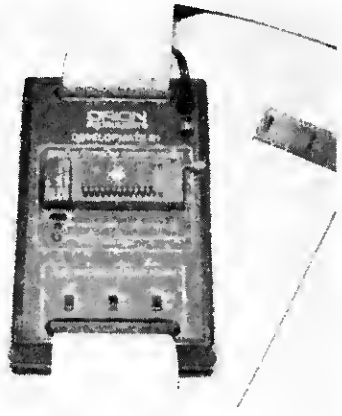

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Listing continued

```
00640   LD      H,06EH
00650   LD      L,A
00660   RET
00670 ZPAGEY    LD      A,(IX)          ;ZERO PAGE INDEXED Y MODE
00680   INC     IX
00690   CALL    ADY
00700   LD      H,06EH
00710   LD      L,A
00720   RET
00730 ABSX      CALL    ABS             ;ABSOLUTE INDEXED X MODE
00740   LD      A,0
00750   CALL    ADX
00760   LD      C,A
00770   LD      B,0
00780   ADD     HL,BC
00790   RET
00800 ABSY      CALL    ABS             ;ABSOLUTE INDEXED Y MODE
00810   LD      A,0
00820   CALL    ADY
00830   LD      C,A
00840   LD      B,0
00850   ADD     HL,BC
00860   RET
00870 ZEROP     EQU     06E00H          ;ZERO PAGE ASSIGNED 6E00H
00880 ADlC      CALL    IM              ;ADC  ADD CARRY IMMEDIATE
00890   LD      B,A
00900 HERE2     LD      HL,DECI         ;CHECK FOR DECIMAL MODE
00910   LD      A,(HL)
00920   OR      A
00930   JP      Z,GO
00940   EX      AF,AF'
00950   ADC     A,B
00960   DAA
00970   EX      AF,AF'
00980   RET
00990 GO        EX      AF,AF'
01000   ADC     A,B
01010   EX      AF,AF'
01020   RET
01030 AD2C      CALL    ABS             ;ADC ADD CARRY
01040 GO1       LD      B,(HL)
01050   JP      HERE2
01060 AD3C      CALL    ZPAGE
01070   JP      GO1
01080 AD4C      CALL    INDX
01090   JP      GO1
01100 AD5C      CALL    INDY
01110   JP      GO1
01120 AD6C      CALL    ZPAGEX
01130   JP      GO1
01140 AD7C      CALL    ABSX
01150   JP      GO1
01160 AD8C      CALL    ABSY
01170   JP      GO1
01180 ANlD      CALL    IM              ;AND COMMAND
01190 GO2       LD      B,A
01200   EX      AF,AF'
01210   AND     B
01220   EX      AF,AF'
01230   RET
01240 AN2D      CALL    ABS
01250 HERE3     LD      A,(HL)
01260   JP      GO2
01270 AN3D      CALL    ZPAGE
01280   JP      HERE3
01290 AN4D      CALL    INDX
01300   JP      HERE3
01310 AN5D      CALL    INDY
01320   JP      HERE3
01330 AN6D      CALL    ZPAGEX
01340   JP      HERE3
01350 AN7D      CALL    ABSX
01360   JP      HERE3
01370 AN8D      CALL    ABSY
01380   JP      HERE3
01390 AS1L      CALL ABS                ;ASL  ARITH SHIFT LEFT
01400   EX      AF,AF'
01410 GO4       SLA     (HL)
01420   EX      AF,AF'
01430   RET
01440 AS2L      CALL    ZPAGE
01450   JP      GO4
01460 AS3L      EX      AF,AF'
01470   SLA     A
01480   EX      AF,AF'
01490   RET
01500 AS4L      CALL    ZPAGEX
01510   JP      GO4
01520 AS5L      CALL    ABSX
01530   JP      GO4
01540 BClC      EX      AF,AF'          ;BCC BRANCH CARRY CLEAR
01550   JP      C,DN3
01560   LD      C,(IX)
01570   INC     IX
01580   CALL    ADRNEW
01590   RET
01600 ADRNEW    EX      AF,AF'
01610   PUSH    IX
01620   POP     DE
01630   LD      A,E
01640   ADD     A,C
01650   LD      E,A
01660   PUSH    DE
01670   POP     IX
01680   RET
01690 BClS      EX      AF,AF'          ;BCS  BRANCH CARRY SET
01700   JP      NC,DN3
01710   LD      C,(IX)
01720   INC     IX
01730   CALL    ADRNEW
01740   RET
01750 BEQ       EX      AF,AF'          ;BEQ  BRANCH EQUAL
01760   JP      NZ,DN3
01770   LD      C,(IX)
01780   INC     IX
01790   CALL    ADRNEW
01800   RET
01810 BIlT      CALL    ABS             ;BIT  BIT TEST
01820 HERE5     EX      AF,AF'
01830   AND     (HL)
01840   EX      AF,AF'
01850   RET
01860 BI2T      CALL    ZPAGE
01870   JP      HERE5
01880 BMI       EX      AF,AF'          ;BMI BRANCH MINUS
01890   JP      P,DN3
01900 GO5       LD      C,(IX)
```

Listing continues

```
01910    INC     IX
01920    CALL    ADRNEW
01930    RET
01940 BNE       EX      AF,AF'          ;BNE BRANCH NOT EQUAL
01950    JP      Z,DN3
01960    JP      GO5
01970 DN3       EX      AF,AF'
01980    INC     IX
01990    RET
02000 BPL       EX      AF,AF'          ;BPL  BRANCH PLUS
02010    JP      M,DN3
02020    JP      GO5
02030 BRK       NOP                     ;BREAK  NOT IMPLEMENTED
02040    RET
02050 BVC       EX      AF,AF'          ;BVC BRANCH OVERFLOW CLEAR
02060    JP      PO,DN3
02070    JP      GO5
02080 BVS       EX      AF,AF'          ;BVS BRANCH OVERFLOW SET
02090    JP      PE,DN3
02100    JP      GO5
02110 CLC       EX      AF,AF'          ;CLC  CLEAR CARRY
02120    SCF
02130    CCF
02140    EX      AF,AF'
02150    RET
02160 CLD       EX      AF,AF'          ;CLD CLEAR DECIMAL FLAG
02170    PUSH    AF
02180    POP     BC
02190    RES     3,C
02200    PUSH    BC
02210    POP     AF
02220    EX      AF,AF'
02230    RET
02240 CLI       EX      AF,AF'          ;CLI  CLEAR INTERRUPT FLAG
02250    PUSH    AF
02260    POP     BC
02270    RES     2,C
02280    PUSH    BC
02290    POP     AF
02300    EX      AF,AF'
02310    RET
02320 CLV       EX      AF,AF'          ;CLV  CLEAR OVERFLOW FLAG
02330    PUSH    AF
02340    POP     BC
02350    RES     6,C
02360    PUSH    BC
02370    POP     AF
02380    EX      AF,AF'
02390    RET
02400 CM1P      CALL    IM              ;CMP    COMPARE A REG
02410 HERE6     LD      B,A
02420    EX      AF,AF'
02430    CP      B
02440    CCF
02450    EX      AF,AF'
02460    RET
02470 CM2P      CALL    ABS
02480    LD      A,(HL)
02490    JP      HERE6
02500 CM3P      CALL    ZPAGE
02510    LD      A,(HL)
02520    JP      HERE6
02530 CM4P      CALL    INDX
02540    LD      A,(HL)
02550    JP      HERE6
02560 CM5P      CALL    INDY
02570    LD      A,(HL)
02580    JP      HERE6
02590 CM6P      CALL    ZPAGEX
02600    LD      A,(HL)
02610    JP      HERE6
02620 CM7P      CALL    ABSX
02630    LD      A,(HL)
02640    JP      HERE6
02650 CM8P      CALL    ABSY
02660    LD      A,(HL)
02670    JP      HERE6
02680 CPX       CALL    IM              ;CPX  COMPARE X REG
02690    LD      C,A
02700 HERE7     EX      AF,AF'
02710    LD      B,A
02720    EXX
02730    PUSH    BC
02740    EXX
02750    POP     DE
02760    LD      A,E
02770    CP      C
02780    CCF
02790    LD      A,B
02800    EX      AF,AF'
02810    RET
02820 CP1X      CALL    ABS
02830    LD      C,(HL)
02840    JP      HERE7
02850 CP2X      CALL    ZPAGE
02860    LD      C,(HL)
02870    JP      HERE7
02880 CP1Y      CALL    IM              ;CPY  COMPAGE Y REG
02890    LD      C,A
02900 HERE7A    EX      AF,AF'
02910    LD      B,A
02920    EXX
02930    PUSH    BC
02940    EXX
02950    POP     DE
02960    LD      A,D
02970    CP      C
02980    CCF
02990    LD      A,B
03000    EX      AF,AF'
03010    RET
03020 CP2Y      CALL    ABS
03030    LD      C,(HL)
03040    JP      HERE7A
03050 CP3Y      CALL    ZPAGE
03060    LD      C,(HL)
03070    JP      HERE7A
03080 DE1C      CALL    ABS             ;DEC  DECREMENT
03090    EX      AF,AF'
03100    DEC     (HL)
03110    EX      AF,AF'
03120    RET
03130 DE2C      CALL    ZPAGE
03140 HERE8     EX      AF,AF'
03150    DEC     (HL)
03160    EX      AF,AF'
```

Listing continues on p. 94

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MOD I or MOD III

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Manufacturer's Suggested List
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MOD I or MOD III

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PDIRT/CMD	PBOOT/CMD
PASSGO/CMD	PFILT/FLT
PUN/CMD	DVORAK/FLT
PEX/CMD	DVORAK/JCL
PMOD/CMD	CODE/JCL
PFIND/CMD	DECODE/JCL

MOD I or MOD III

POWERDRAW
BY Powersoft

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0) CONDENSED TOKENS
1) EDAS Source file format
2) EDTASM Source file format
3) BASIC data statements
4) BASIC strings
5) BASIC arrays (New in version 1.3!)
6) Load File Format
Many more features! Completely cursor controlled. PowerDRAW comes complete with PDRAW/CMD, as well as three other utilities written by Kim for extending the use of PowerDraw. Also has 3 printer drivers including one that is specifically written for the Epson printer with or without Graftrax! That means all the graphics you design may be printed out PERFECTLY on your printer! Works with joystick also.

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MICRO-80 provides some of the most advanced and most convenient features ever incorporated in a microcomputer bulletin board system including:
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Users may "upload", or transmit, data and programs files to MICRO-80. These programs may then be "downloaded" to other MICRO-80 users.
MICRO-80 is self maintaining. Message space is automatically reclaimed when messages are deleted.

MOD I or III

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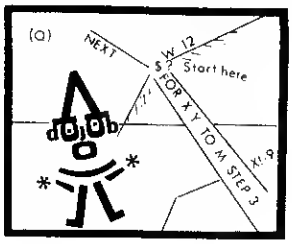
Listing continued from p. 91

```
03170   RET
03180 DE3C      CALL    ZPAGEX
03190   JP      HERE8
03200 DE4C      CALL    ABSX
03210   JP      HERE8
03220 DEX       EX      AF,AF'          ;DEX DECREMENT X
03230   EXX
03240   DEC     C
03250   EX      AF,AF'
03260   EXX
03270   RET
03280 DEY       EX      AF,AF'          ;DEY  DECREMENT Y
03290   EXX
03300   DEC     B
03310   EX      AF,AF'
03320   EXX
03330   RET
03340 EOR1      CALL    IM              ;EOR  EXCLUSIVE OR
03350 HERE9     LD      B,A
03360   EX      AF,AF'
03370   XOR     B
03380   EX      AF,AF'
03390   RET
03400 EOR2      CALL    ABS
03410   LD      A,(HL)
03420   JP      HERE9
03430 EOR3      CALL    ZPAGE
03440   LD      A,(HL)
03450   JP      HERE9
03460 EOR4      CALL    INDX
03470   LD      A,(HL)
03480 EOR5      CALL    INDY
03490   LD      A,(HL)
03500   JP      HERE9
03510 EOR6      CALL    ZPAGEX
03520   LD      A,(HL)
03530   JP      HERE9
03540 EOR7      CALL    ABSX
03550   LD      A,(HL)
03560   JP      HERE9
03570 EOR8      CALL    ABSY
03580   LD      A,(HL)
03590   JP      HERE9
03600 IN1C      CALL    ABS             ;INC    INCREMENT
03610   EX      AF,AF'
03620   INC     (HL)
03630   EX      AF,AF'
03640   RET
03650 IN2C      CALL    ZPAGE
03660 HERE10    EX      AF,AF'
03670   INC     (HL)
03680   EX      AF,AF'
03690   RET
03700 IN3C      CALL    ZPAGEX
03710   JP      HERE10
03720 IN4C      CALL    ABSX
03730   JP      HERE10
03740 INCX      EX      AF,AF'          ;INX  INCREMENT X
03750   EXX
03760   INC     C
03770   EX      AF,AF'
03780   EXX
03790   RET
03800 INCY      EX      AF,AF'          ;INY  INCREMENT Y
03810   EXX
03820   INC     B
03830   EX      AF,AF'
03840   EXX
03850   RET
03860 JM1P      CALL    ABS             ;JMP  JUMP
03870   PUSH    HL
03880   POP     IX
03890   RET
03900 JM2P      LD      L,(IX)
03910   INC     IX
03920   LD      H,(IX)
03930   INC     IX
03940   LD      C,(HL)
03950   INC     HL
03960   LD      B,(HL)
03970   PUSH    BC
03980   POP     IX
03990   RET
04000 JSR       CALL    ABS             ;JSR JUMP SUBROUTINE
04010   EXX
04020   PUSH    IX
04030   POP     DE
04040   LD      (HL),D
04050   DEC     HL
04060   LD      (HL),E
04070   DEC     HL
04080   EXX
04090   PUSH    HL
04100   POP     IX
04110   RET
04120 LD1A      CALL    IM              ;LDA  LOAD A REG
04130 HERE11    LD      B,A
04140   EX      AF,AF'
04150   LD      A,B
04160   INC     A
04170   DEC     A
04180   EX      AF,AF'
04190   RET
04200 LD2A      CALL    ABS
04210 HERE12    LD      A,(HL)
04220   JP      HERE11
04230 LD3A      CALL    ZPAGE
04240   JP      HERE12
04250 LD4A      CALL    INDX
04260   JP      HERE12
04270 LD5A      CALL    INDY
04280   JP      HERE12
04290 LD6A      CALL    ZPAGEX
04300   JP      HERE12
04310 LD7A      CALL    ABSX
04320   JP      HERE12
04330 LD8A      CALL    ABSY
04340   JP      HERE12
04350 LD1X      CALL    IM              ;LDX  LOAD X REG
04360 HERE13    EXX
04370   LD      C,A
04380   EX      AF,AF'
04390   INC     C
04400   DEC     C
04410   EXX
04420   EX      AF,AF'
```

Listing continues

Lost in the Line Edit Jungle?



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3-WINNING FANFARE
4-LOSING FANFARE
5-RASPBERRY
6-WHITE NOISE
7-CREAKING DOOR
8-TRIMFONE
9-TV TENNIS
10-SFORZANOO
11-GUNFIRE
12-FREQUENCY SELECTION
13-QWERTYUI PIANO KEYBOARD

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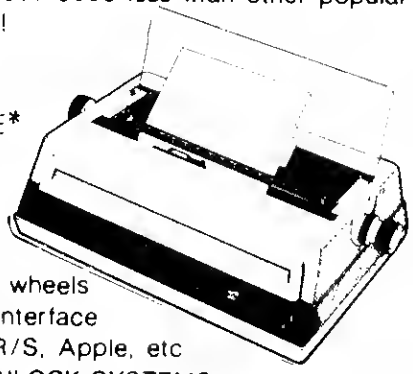

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Listing continued

```
04430   RET
04440 LD2X      CALL    ABS
04450   LD      A,(HL)
04460   JP      HERE13
04470 LD3X      CALL    ZPAGE
04480   LD      A,(HL)
04490   JP      HERE13
04500 LD4X      CALL    ABSY
04510   LD      A,(HL)
04520   JP      HERE13
04530 LD5X      CALL    ZPAGEY
04540   LD      A,(HL)
04550   JP      HERE13
04560 LD1Y      CALL    IM              ;LDY    LOAD Y REG
04570 HERE14    EXX
04580   LD      B,A
04590   EX      AF,AF'
04600   INC     B
04610   DEC     B
04620   EXX
04630   EX      AF,AF'
04640   RET
04650 LD2Y      CALL    ABS
04660   LD      A,(HL)
04670   JP      HERE14
04680 LD3Y      CALL    ZPAGE
04690   LD      A,(HL)
04700   JP      HERE14
04710 LD4Y      CALL    ZPAGEX
04720   LD      A,(HL)
04730   JP      HERE14
04740 LD5Y      CALL    ABSX
04750   LD      A,(HL)
04760   JP      HERE14
04770 LS1R      CALL    ABS             ;LSR  LOGICAL SHIFT RIGHT
04780 HERE15    EX      AF,AF'
04790   SRL     (HL)
04800   EX      AF,AF'
04810   RET
04820 LS2R      CALL    ZPAGE
04830   JP      HERE15
04840 LS3R      EX      AF,AF'
04850   SRL     A
04860   EX      AF,AF'
04870   RET
04880 LS4R      CALL    ZPAGEX
04890   JP      HERE15
04900 LS5R      CALL    ABSX
04910   JP      HERE15
04920 NO1P      RET             ;NOP    NO OPERATION
04930 OR1A      CALL    IM              ;ORA    OR A REG
04940 HERE16    LD      B,A
04950   EX      AF,AF'
04960   OR      B
04970   EX      AF,AF'
04980   RET
04990 OR2A      CALL    ABS
05000   LD      A,(HL)
05010   JP      HERE16
05020 OR3A      CALL    ZPAGE
05030   LD      A,(HL)
05040   JP      HERE16
05050 OR4A      CALL    INDX
05060   LD      A,(HL)
05070   JP      HERE16
05080 OR5A      CALL    INDY
05090   LD      A,(HL)
05100   JP      HERE16
05110 OR6A      CALL    ZPAGEX
05120   LD      A,(HL)
05130   JP      HERE16
05140 OR7A      CALL    ABSX
05150   LD      A,(HL)
05160   JP      HERE16
05170 OR8A      CALL    ABSY
05180   LD      A,(HL)
05190   JP      HERE16
05200 PHA       EX      AF,AF'          ;PHA  PUSH A REG
05210   EXX
05220   LD      (HL),A
05230   DEC     HL
05240   EXX
05250   EX      AF,AF'
05260   RET
05270 PHP       EX      AF,AF'          ;PHP    PUSH FLAG REG
05280   EXX
05290   PUSH    AF
05300   POP     DE
05310   LD      (HL),E
05320   DEC     HL
05330   EXX
05340   EX      AF,AF'
05350   RET
05360 PLA       EX      AF,AF'          ;PLA    PULL A REG
05370   EXX
05380   INC     HL
05390   LD      A,(HL)
05400   EX      AF,AF'
05410   EXX
05420   RET
05430 PLP       EX      AF,AF'          ;PLP    PULL FLAG REG
05440   EXX
05450   INC     HL
05460   LD      E,(HL)
05470   LD      D,A
05480   PUSH    DE
05490   POP     AF
05500   EXX
05510   EX      AF,AF'
05520   RET
05530 RO1L      CALL    ABS             ;ROL  ROTATE LEFT
05540 HERE17    EX      AF,AF'
05550   RL      (HL)
05560   EX      AF,AF'
05570   RET
05580 RO2L      CALL    ZPAGE
05590   JP      HERE17
05600 RO3L      EX      AF,AF'
05610   RL      A
05620   EX      AF,AF'
05630   RET
05640 RO4L      CALL    ZPAGEX
05650   JP      HERE17
05660 RO5L      CALL    ABSX
05670   JP      HERE17
05680 RO1R      CALL    ABS             ;ROR  ROTATE RIGHT
```

Listing continues

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WITH

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COPY-NOT IS A COPY PROTECTION PROGRAM WHICH PERMITS BASIC SOFTWARE AUTHOR TO PROTECT HIS CREATION FROM PIRATES. PROGRAMS IN MEMORY RUN IN AN ENCRYPTED MODE FOR MAX-PROTECTION.

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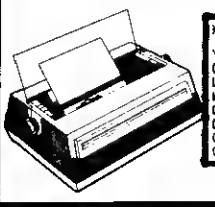

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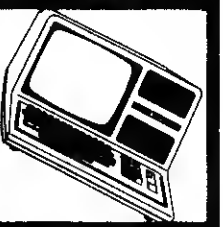

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✓ See List of Advertisers on Page 339

Listing continued

```
05690 HERE18    EX      AF,AF'
05700   RR      (HL)
05710   EX      AF,AF'
05720   RET
05730 RO2R      CALL    ZPAGE
05740   JP      HERE18
05750 RO3R      EX      AF,AF'
05760   RR      A
05770   EX      AF,AF'
05780   RET
05790 RO4R      CALL    ZPAGEX
05800   JP      HERE18
05810 RO5R      CALL    ABSX
05820   JP      HERE18
05830 RTI       NOP                     ;RTI RETRN FROM INTERRUPT
05840   RET
05850 RTS       EXX                     ;RTS RETURN FROM SUBRTN
05860   EX      AF,AF'
05870   INC     HL
05880   LD      E,(HL)
05890   INC     HL
05900   LD      D,(HL)
05910   PUSH    DE
05920   POP     IX
05930   EX      AF,AF'
05940   EXX
05950   RET
05960 SB1C      CALL    IM              ;SBC SUBTRACT WITH CARRY
05970   LD      B,A
05980 HERE19    LD      HL,DECI
05990   LD      A,(HL)
06000   OR      A
06010   JP      Z,GO1A
06020   EX      AF,AF'
06030   CCF
06040   SBC     A,B
06050   DAA
06060   CCF
06070   EX      AF,AF'
06080   RET
06090 GO1A      EX      AF,AF'
06100   CCF
06110   SBC     A,B
06120   CCF
06130   EX      AF,AF'
06140   RET
06150 SB2C      CALL    ABS
06160 HERE20    LD      B,(HL)
06170   JP      HERE19
06180 SB3C      CALL    ZPAGE
06190   JP      HERE20
06200 SB4C      CALL    INDX
06210   JP      HERE20
06220 SB5C      CALL    INDY
06230   JP      HERE20
06240 SB6C      CALL    ZPAGEX
06250   JP      HERE20
06260 SB7C      CALL    ABSX
06270   JP      HERE20
06280 SB8C      CALL    ABSY
06290   JP      HERE20
06300 SEC       EX      AF,AF'          ;SEC SET CARRY FLAG
06310   SCF
06320   EX      AF,AF'
06330   RET
06340 SED       LD      HL,DECI         ;SED    SET DECIMAL FLAG
06350   LD      (HL),1
06360   RET
06370 SEI       EX      AF,AF'          ;SEI  SET INTERRUPT FLAG
06380   NOP
06390   NOP
06400   NOP
06410   EX      AF,AF'
06420   RET
06430 ST1A      CALL    ABS             ;STA    STORE A REG
06440 HERE22    EX      AF,AF'
06450   LD      (HL),A
06460   EX      AF,AF'
06470   RET
06480 ST2A      CALL    ZPAGE
06490   JP      HERE22
06500 ST3A      CALL    INDX
06510   JP      HERE22
06520 ST4A      CALL    INDY
06530   JP      HERE22
06540 ST5A      CALL    ZPAGEX
06550   JP      HERE22
06560 ST6A      CALL    ABSX
06570   JP      HERE22
06580 ST7A      CALL    ABSY
06590   JP      HERE22
06600 ST1X      CALL    ABS             ;STX STORE X REG
06610 HERE23    EXX
06620   PUSH    BC
06630   EXX
06640   POP     BC
06650   LD      (HL),C
06660   RET
06670 ST2X      CALL    ZPAGE
06680   JP      HERE23
06690 ST3X      CALL    ZPAGEY
06700   JP      HERE23
06710 ST1Y      CALL    ABS             ;STY STORE Y REG
06720 HERE24    EXX
06730   PUSH    BC
06740   EXX
06750   POP     BC
06760   LD      (HL),B
06770   RET
06780 ST2Y      CALL    ZPAGE
06790   JP      HERE23
06800 ST3Y      CALL    ZPAGEX
06810   JP      HERE23
06820 TAX       EX      AF,AF'          ;TAX TRANSFER A TO X REG
06830   EXX
06840   LD      C,A
06850   INC     C
06860   DEC     C
06870   EXX
06880   EX      AF,AF'
06890   RET
06900 TAY       EX      AF,AF'          ;TAY TRANSFER A TO Y REG
06910   EXX
06920   LD      B,A
06930   INC     B
```

Listing continues

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Listing continued

```
06940   DEC     B
06950   EXX
06960   EX      AF,AF'
06970   RET
06980 TSX       EX      AF,AF'          ;TSX TRANSFER STACK TO X
06990   EXX
07000   LD      C,(HL)
07010   EX      AF,AF'
07020   EXX
07030   RET
07040 TXA       EX      AF,AF'          ;TXA TRANSFER X TO A REG
07050   EXX
07060   LD      A,C
07070   INC     A
07080   DEC     A
07090   EXX
07100   EX      AF,AF'
07110   RET
07120 TXS       EX      AF,AF'          ;TXS TRANSFER X TO STACK
07130   EXX
07140   LD      (HL),C
07150   EX      AF,AF'
07160   EXX
07170   RET
07180 TYA       EX      AF,AF'          ;TYA TRANSFER Y TO A REG
07190   EXX
07200   LD      A,B
07210   INC     A
07220   DEC     A
07230   EXX
07240   EX      AF,AF'
07250   RET
07260   ORG     7500H           ;LOOK UP TABLE
07270   DEFB    69H
07280   DEFW    AD1C
07290   DEFB    6DH
07300   DEFW    AD2C
07310   DEFB    65H
07320   DEFW    AD3C
07330   DEFB    61H
07340   DEFW    AD4C
07350   DEFB    71H
07360   DEFW    AD5C
07370   DEFB    75H
07380   DEFW    AD6C
07390   DEFB    7DH
07400   DEFW    AD7C
07410   DEFB    79H
07420   DEFW    AD8C
07430   DEFB    29H
07440   DEFW    AN1D
07450   DEFB    2DH
07460   DEFW    AN2D
07470   DEFB    25H
07480   DEFW    AN3D
07490   DEFB    21H
07500   DEFW    AN4D
07510   DEFB    31H
07520   DEFW    AN5D
07530   DEFB    35H
07540   DEFW    AN6D
07550   DEFB    3DH
07560   DEFW    AN7D
07570   DEFB    39H
07580   DEFW    AN8D
07590   DEFB    0EH
07600   DEFW    AS1L
07610   DEFB    06H
07620   DEFW    AS2L
07630   DEFB    0AH
07640   DEFW    AS3L
07650   DEFB    16H
07660   DEFW    AS4L
07670   DEFB    1EH
07680   DEFW    AS5L
07690   DEFB    90H
07700   DEFW    BC1C
07710   DEFB    0B0H
07720   DEFW    BC1S
07730   DEFB    0F0H
07740   DEFW    BEQ
07750   DEFB    2CH
07760   DEFW    BI1T
07770   DEFB    24H
07780   DEFW    BI2T
07790   DEFB    30H
07800   DEFW    BMI
07810   DEFB    0D0H
07820   DEFW    BNE
07830   DEFB    10H
07840   DEFW    BPL
07850   DEFB    00
07860   DEFW    BRK
07870   DEFB    50H
07880   DEFW    BVC
07890   DEFB    70H
07900   DEFW    BVS
07910   DEFB    18H
07920   DEFW    CLC
07930   DEFB    0D8H
07940   DEFW    CLD
07950   DEFB    58H
07960   DEFW    CLI
07970   DEFB    0B8H
07980   DEFW    CLV
07990   DEFB    0C9H
08000   DEFW    CM1P
08010   DEFB    0CDH
08020   DEFW    CM2P
08030   DEFB    0C5H
08040   DEFW    CM3P
08050   DEFB    0C1H
08060   DEFW    CM4P
08070   DEFB    0D1H
08080   DEFW    CM5P
08090   DEFB    0D5H
08100   DEFW    CM6P
08110   DEFB    0DDH
08120   DEFW    CM7P
08130   DEFB    0D9H
08140   DEFW    CM8P
08150   DEFB    0E0H
08160   DEFW    CPX
08170   DEFB    0ECH
08180   DEFW    CP1X
08190   DEFB    0E4H
08200   DEFW    CP2X
08210   DEFB    0C0H
08220   DEFW    CP1Y
08230   DEFB    0CCH
08240   DEFW    CP2Y
08250   DEFB    0C4H
08260   DEFW    CP3Y
08270   DEFB    0CEH
08280   DEFW    DE1C
08290   DEFB    0C6H
08300   DEFW    DE2C
08310   DEFB    0D6H
08320   DEFW    DE3C
08330   DEFB    0DEH
08340   DEFW    DE4C
08350   DEFB    0CAH
08360   DEFW    DEX
08370   DEFB    88H
08380   DEFW    DEY
08390   DEFB    49H
08400   DEFW    EOR1
08410   DEFB    4DH
08420   DEFW    EOR2
08430   DEFB    45H
08440   DEFW    EOR3
08450   DEFB    41H
08460   DEFW    EOR4
08470   DEFB    51H
08480   DEFW    EOR5
08490   DEFB    55H
08500   DEFW    EOR6
08510   DEFB    5DH
08520   DEFW    EOR7
08530   DEFB    59H
08540   DEFW    EOR8
08550   DEFB    0EEH
08560   DEFW    IN1C
08570   DEFB    0E6H
08580   DEFW    IN2C
08590   DEFB    0F6H
08600   DEFW    IN3C
08610   DEFB    0FEH
08620   DEFW    IN4C
08630   DEFB    0E8H
08640   DEFW    INCX
08650   DEFB    0C8H
08660   DEFW    INCY
08670   DEFB    4CH
08680   DEFW    JM1P
08690   DEFB    6CH
08700   DEFW    JM2P
08710   DEFB    20H
08720   DEFW    JSR
08730   DEFB    0A9H
08740   DEFW    LD1A
08750   DEFB    0ADH
08760   DEFW    LD2A
08770   DEFB    0A5H
08780   DEFW    LD3A
08790   DEFB    0A1H
08800   DEFW    LD4A
08810   DEFB    0B1H
08820   DEFW    LD5A
08830   DEFB    0B5H
```

Listing continues

Listing continued

```
08840   DEFW    LD6A
08850   DEPB    0BDH
08860   DEFW    LD7A
08870   DEFB    0B9H
08880   DEFW    LD8A
08890   DEFB    0A2H
08900   DEFW    LD1X
08910   DEFB    0AEH
08920   DEFW    LD2X
08930   DEFB    0A6H
08940   DEFW    LD3X
08950   DEFB    0BEH
08960   DEFW    LD4X
08970   DEFB    0B6H
08980   DEFW    LD5X
08990   DEFB    0A0H
09000   DEFW    LD1Y
09010   DEFB    0ACH
09020   DEFW    LD2Y
09030   DEFB    0A4H
09040   DEFW    LD3Y
09050   DEFB    0B4H
09060   DEFW    LD4Y
09070   DEFB    0BCH
09080   DEFW    LD5Y
09090   DEFB    4EH
09100   DEFW    LS1R
09110   DEFB    46H
09120   DEFW    LS2R
09130   DEFB    4AH
09140   DEFW    LS3R
09150   DEFB    56H
09160   DEFW    LS4R
09170   DEFB    5EH
09180   DEFW    LS5R
09190   DEFB    0EAH
09200   DEFW    NO1P
09210   DEFB    09H
09220   DEFW    OR1A
09230   DEFB    0DH
09240   DEFW    OR2A
09250   DEFB    05H
09260   DEFW    OR3A
09270   DEFB    01
09280   DEFW    OR4A
09290   DEFB    11H
09300   DEFW    OR5A
09310   DEFB    15H
09320   DEFW    OR6A
09330   DEFB    1DH
09340   DEFW    OR7A
09350   DEFB    19H
09360   DEFW    OR8A
09370   DEFB    48H
09380   DEFW    PHA
09390   DEFB    08H
09400   DEFW    PHP
09410   DEFB    68H
09420   DEFW    PLA
09430   DEFB    28H
09440   DEFW    PLP
09450   DEFB    2EH
09460   DEFW    RO1L
09470   DEFB    26H
09400   DEFW    RO2L
09490   DEFB    2AH
09500   DEFW    RO3L
09510   DEFB    36H
09520   DEFW    RO4L
09530   DEFB    3EH
09540   DEFW    RO5L
09550   DEFB    6EH
09560   DEFW    RO1R
09570   DEFB    66H
09580   DEFW    RO2R
09590   DEFB    6AH
09600   DEFW    RO3R
09610   DEFB    76H
09620   DEFW    RO4R
09630   DEFB    7EH
09640   DEFW    RO5R
09650   DEFB    40H
09660   DEFW    RTI
09670   DEFB    60H
09680   DEFW    RTS
09690   DEFB    0E9H
09700   DEFW    SB1C
09710   DEFB    0EDH
09720   DEFW    SB2C
09730   DEFB    0E5H
09740   DEFW    SB3C
09750   DEFB    0E1H
09760   DEFW    SB4C
09770   DEFB    0F1H
09780   DEFW    SB5C
09790   DEFB    0F5H
09000   DEFW    SB6C
09810   DEFB    0FDH
09820   DEFW    SB7C
09830   DEFB    0F9H
09840   DEFW    SB8C
09850   DEFB    38H
09860   DEFW    SEC
09870   DEFB    0F8H
09880   DEFW    SED
09890   DEFB    78H
09900   DEFW    SEI
09910   DEFB    8DH
09920   DEFW    ST1A
09930   DEFB    85H
09940   DEFW    ST2A
09950   DEFB    81H
09960   DEFW    ST3A
09970   DEFB    91H
09980   DEFW    ST4A
09990   DEFB    95H
10000   DEFW    ST5A
10010   DEFB    9DH
10020   DEFW    ST6A
10030   DEFB    99H
10040   DEFW    ST7A
10050   DEFB    8EH
10060   DEFW    ST1X
10070   DEFB    86H
10080   DEFW    ST2X
10090   DEFB    96H
10100   DEFW    ST3X
10110   DEFB    8CH
10120   DEFW    ST1Y
10130   DEFB    84H
10140   DEFW    ST2Y
10150   DEFB    94H
10160   DEFW    ST3Y
10170   DEFB    0AAH
10180   DEFW    TAX
10190   DEFB    0A8H
10200   DEFW    TAY
10210   DEFB    0BAH
10220   DEFW    TSX
10230   DEFB    8AH
10240   DEFW    TXA
10250   DEFB    9AH
10260   DEFW    TXS
10270   DEFB    98H
10280   DEFW    TYA
10290 TOP       DEFW    0000            ;END OF TABLE
10300 DECI      DEFB    00              ;SUBSTITUE DECIMAL FLAG
10310   DEFB    00
10320   ORG     8000H
10330 BEGIN     CALL    START           ;START OF EMULATOR SUB.
10340   JP      BEGIN
10350 START     PUSH    HL              ;SAVE BREAK PT.
10360   LD      A,(IX)          ;GET NEXT INSTR.
10370   INC     IX
10380   LD      HL,7500H        ;LOAD HL WITH TABLE ADDR
10390   LD      DE,TOP
10400 LOOP      CP      (HL)            ;SEARCH TABLE
10410   JP      Z,FOUND
10420   INC     HL
10430   INC     HL
10440   INC     HL
10450   PUSH    AF
10460   RST     18H
10470   JP      Z,ERROR
10480   POP     AF
10490   JP      LOOP
10500 FOUND     INC     HL              ;COMMAND FOUND
10510   LD      DE,INST+1
10520   LD      A,(HL)
10530   LD      (DE),A
10540   INC     HL
10550   INC     DE
10560   LD      A,(HL)
10570   LD      (DE),A
10580 INST      DEFB    0CDH    ;SUBRTN ADDR LOADED HERE
10590   DEFB    0               ;AND THEN CALLED
10600   DEFB    0
10610   POP     HL              ;GET BREAK PT ADDR
10620   LD      A,H             ;CHECH FOR 0
10630   OR      L
10640   JP      Z,STOP
10650   PUSH    IX              ;REACHED BREAK PT. ?
10660   POP     DE
10670   RST     18H
10680   JP      Z,STOP
10690   JP      START
10700 STOP      RET
10710 ERROR     JP      ERROR
10720   END
```

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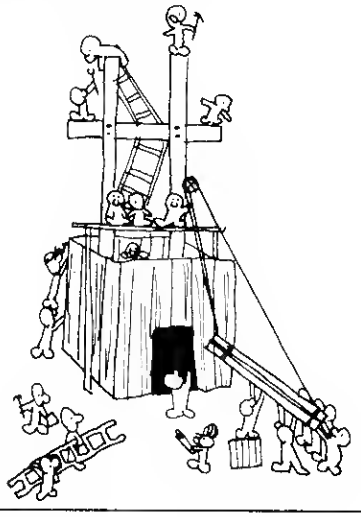

Basic, Faster and Readable—Part I

by John Corbani

If you remember some of the rules you learned about grammar so long ago, then you should be able to use Basic effectively and efficiently.

The microcomputer industry was built on Microsoft Basic, and with good reason: Basic gets you from here to there in a reasonable amount of time using rules known by anyone who made it through elementary school. All you need is a reasonable understanding of English grammar.

But Microsoft Basic has a tremendous number of unwritten rules that either get you into or out of trouble. This series of articles will help you use those rules, along with the generally accepted rules of grammar, to write programs that run well, are understandable, and are maintainable.

The Rules

Format and punctuate Basic statements using the same rules used in an English sentence, paragraph, or sequence of phrases. Think of a numbered Basic statement as a sentence. Organize statements into groups and put common groups in their own numbered statement as you would put sentences into a paragraph.

Format the text into columns if reasonable. Basic allows 255 characters per numbered statement. Use as many characters per statement and as many physical lines as make sense. Use LF and spaces as required for exact format. Use spaces and punctuation only when required for readability and where speed constraints make it plausible. See Program Listings 1a and 1b.

Listing 1a is a statement combination that might normally run once when initializing a program. There are no particular constraints on timing, so open things up and give yourself a chance to breathe, as in 1b.

Punctuation is used at the end of statements and lines, as in English. Data is formatted into easily readable rows and columns.

Secondary lines are indented to the same starting position as the text of the first line. The read loop is a complete thought and has its own line. Spaces are used only where readability is improved; note "A=1." No improvement in readability is obtained by typing "A = 1."

NEXT does not require an argument. Don't use one unless there is a possibility of confusion. LET is an anachronism; there is no good reason for its use.

REM statements in programs can either be useful or they can slow things down. It makes sense to identify all major blocks or subroutines. If you put a REM statement immediately in front of a called line number, there will be no speed overhead. Remarks after a GOTO or a RETURN incur no loss of speed overhead and can be used freely. All other situations are suspect.

If you are almost out of memory or character space, remember that REM is saved as one character even though it prints as three. A single quote (') used in place of REM requires 2 bytes of storage even though it prints as one character.

Blank lines in a listing can do wonders to ease readability. If you want a mostly blank line somewhere, type a single quote, a line feed, three or four spaces and a second single quote. The spaces are required only for Centronics printers that overshoot after returning from printing a short line. The trailing single quote gives a smart printer something to do after a series of unprintable characters. A REM statement that incorporates leading and trailing blank lines really gets your attention.

Print is, by far, the fastest and one of the most commonly used Basic operations. There are many ways to perform most print functions and they each have their place. A good starting point for looking at the possibilities is to first position the cursor for printing.

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```
40  REM          TEST
50  DATA84,72,73,83,32,73,83,32,65,32,84,69,83,84,32,76,73,78,69,46,13
60  FORA=1TO21:READX(A):NEXTA:LETA=2
```

Program Listing 1a

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start at memory address 15360 and go for 1,024 bytes, 64 bytes per line, 16 lines per screen. POKE 15360,95 puts a cursor (underline) in the upper left corner of the screen. POKE 15360,32 (space) erases it. While this combination puts what looks like a cursor anywhere on the screen, print statements start wherever they left off after the last print command.

```
40  '
                TEST
    '
50  DATA
    84,72,73,83,32,73,83,32,65,32,
    84,69,83,84,32,76,73,78,69,46,
    13
60  FOR A=1 TO 21: READ X(A): NEXT:
    A=2
```

Program Listing 1b

A device control block (DCB) positions the cursor for print commands. The DCB is set by either print or POKE commands. If you POKE the right number in this 2-byte block, you move the print position wherever you want it. The high byte address is at 16417 and should hold the integer result of dividing the desired screen address by 256. The low byte (16416) holds the remainder after the division. There are times when doing two POKEs is easier or faster than printing. Integer variables for both data and addresses can make things go even faster. Try:

```
POKE 16417, 60: POKE 16416, 0:
```

The next character printed appears in the upper left corner of the screen. Try again:

```
POKE 16417, 60: POKE 16416, 130:
```

The next character printed appears as the third character of the third line.

There are other ways to get from here to there:

```
PRINT @ 130,;: or
PRINT CHR$(28) CHR$(2,26) CHR$(2,25);:
```

The first line is straightforward. Print position zero is the upper left corner of the screen. The second statement puts the cursor at the upper left corner of the screen, moves it down two lines and over two spaces. Characters 24 (left), 25 (right), 26 (down), and 27 (up) move the cursor to the next print position without affecting text already on the screen.

Watch out for TAB(n). It is not the same as PRINT STRING$(n,25). The tab function prints spaces from where you are to column (n) and erases anything it crosses (not good for moving a cursor from the front to the middle of a full line when you want to keep the old text). Character numbers from 192–255 are space strings ranging in length from one character (192) to 64 characters (255). These work just like STRING$(n,32) where n ranges from one to 64.

```
PRINT CHR$(201):: or
PRINT STRING$(10,32);:
```

Both statements give you 10 spaces in a row. Anything in the way is cleared out.

Back to positioning for a print command. Try keeping a variable for the X and the Y axes of the screen when you must print in random positions.

```
560  X=2: Y=128
570  PRINT @ X+Y,;
```

Lines 560 and 570 cause subsequent printing to start at the third character position of the third line. The addition overhead is not too bad.

Once you've established the print position, use the Basic punctuation that will print what you want using the fewest readable source code characters possible. A space is as good a character delimiter as the textbook semicolon in most cases and it's easier to read.

Program Listing 2 shows three lines that print the same message at the same place on the screen. 570 is a mess to read, but it runs. 580 is what you might do if you read more into the Radio Shack instructions than is really there. 590 is more readable and only one byte longer. The semicolon after the M separates the two numeric variables. With-

```
570  PRINT@130,A$NTAB(10)M;A"DAYS"
580  PRINT @ 130, A$;N;TAB(10) M;A;"DAYS"
590  PRINT @ 130, A$ N TAB(10) M; A "DAYS"
```

Program Listing 2

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out the semicolon, Basic prints the value of M A, a three-character variable with only the first two characters being significant. Remember, all Basic key words are delimiters.

Formatting strings to be printed is much slower than the printing itself. If much formatting is involved, the famed garbage collection monster slows you down for minutes at a time. LEFT$, MID$, RIGHT$, concatenation (A$ = A$ + IN$), redefining a string (A$ = B$), and using USING burn up a new chunk of memory every time they are called. When memory is all used up, Basic goes back through string memory and sorts leftover fragments from good data. It takes forever to throw out the junk, compress the good data and get back to work.

Format the screen and position the cursor using PRINT @ and POKE whenever practical. It can be faster than PRINT STRING$(n,n) or TAB(n).

INPUT n$ is always a dangerous command. In addition to exercising string-handling routines, unexpected input can bomb the program.

INKEY$ or PEEK work better when you do as little string manipulation as possible. Is any key pressed? Try I = PEEK(15359). If I>0 then a key is down. If you have to use INKEY$ and have to test for a lot of control characters, try something like Program Listing 3. The code tests to see whether the return, left-arrow, right-arrow, and space keys have been pressed.

Testing a single character numeric variable against a *small* constant is faster than testing against a numeric variable in most cases, and as fast as comparing a string with a string. If you are sure a string manipulation is necessary, then go ahead. Once you are committed to playing with a string, finish it up and save it the way it will be printed later. Writing B$ = A$ + IN$ sets you up to print B$ in half the time it takes to print A$ + IN$. Of course, you must have a reason to print or otherwise manipulate the combination more than once before you make the effort. ■

John Corbani's hobbies include programming, radio-controlled model aircraft, sailboats and railroading, skiing, and windsurfing.

```
390   '
                  SCAN KEYBOARD
      '
400   I$=INKEY$: IF I$="" THEN 400 ELSE I=ASC(I$)
410   IF I=13 THEN xxx ELSE
      IF I=8 THEN yyy ELSE
      IF I=9 THEN zzz ELSE
      IF I>31 THEN 440
420   GOTO 400
430   '
                  ADD I$ TO IN$
      '
440   IN$=IN$+I$
450   GOTO 400
```

Program Listing 3

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Find Record with Part of a Key	YES	YES	NO	NO
Hi-Speed Global Search for ANY Field in a Record	YES	YES	NO	NO
Duplicate Keys and Multiple Keys Supported	YES	YES	limited	NO
Global Field Replacement Function	YES	YES	NO	NO
Run Predefined Reports from Finished Program	YES	YES	NO	NO
Select Reports from Menu in Finished Program	YES	NO	NO	NO
Sort (machine language) ANY Field-Free	YES	NO	NO	NO
Custom Mailing Labels Option (any Size)	YES	NO	NO	NO
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Use ALL Math Functions in Calculations	YES	NO	NO	NO
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For an independent product review of the PRODUCER see page 62 of March issue of 80 Micro

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Color Sketchpad

by Larry Colle

Creating graphics on your Color Computer is tedious when you have to program the necessary commands. You can avoid this ennui with Draw, a CoCo program that lets you design graphics using your keyboard.

Draw runs on a 16K Color Computer. It includes three Extended Basic functions (Line, Circle, and Paint) and provides four colors. You can create many types of graphics, including pictures and gameboards.

By using your keyboard to draw, you can avoid the drudgery of designing graphics.

How to Use Draw

When you run Draw, a pixel-sized dot (the cursor) appears in the center of the screen. Move the cursor one space at a time with one of the four arrow keys. Move it continuously by pressing shift and an arrow key simultaneously; the cursor moves until you press another key or until it encounters the edge of the graphics screen.

Change the cursor's color by pressing 1, 2, 3, or 4. These numbers correspond to the colors in the color graphics modes. Pressing 1 makes the cursor disappear, because 1 is the background color. To change from one color set to the other, press R.

To set a pixel's color, move the cursor to the pixel, select a color, and press S. Then, every pixel that the cursor passes over adopts this color. Change color by pressing a number key.

Draw horizontal and vertical lines by pressing shift and an arrow key. With some colors, the horizontal and vertical lines are different shades because of the built-in video display generator's border function. To leave the set mode, press S.

Drawing diagonal lines is easy with the line function. Position the cursor where you want the line to begin and press L. Then place the cursor where you want the line to end and again press L. The line appears between these points. This function's shortcoming is that it uses Extended Basic's Line function and draws only in the foreground color. But using this function is much easier than drawing a line one point at a time.

To draw a circle, position the cursor on the pixel desired for the circle's center, and press C. Then, move the cursor to a pixel on the circumference of the circle and press C again. A circle the color of the cursor appears.

With the Paint function, you can color large areas. Change the cursor to the preferred color and draw a border around the area. Position the cursor inside the area and press P; the area fills with the selected color. You can also paint circles with this method.

A Few Tips

To erase, move the cursor to the appropriate pixels. Change the cursor to the background color, 1. Then, using the set option, erase the pixels by replacing them with the background color.

When the cursor passes through an

The Key Box

Color Computer
16K RAM
Extended Color Basic

Line	Modification			
20	Change	PMODE3, 1	to	PMODE4, 1
50	Change	F=1	to	F=2
400	Change	Both (X+2)s	to	X+1
400	Change	253	to	254
415	Change	X+2	to	X+1
420	Change	Both (X−2)s	to	X−1
420	Change	2	to	1
435	Change	X−2	to	X−1

Table 1. To use PMODE4, make these modifications.

Variable	Function
X	Horizontal coordinate
Y	Vertical coordinate
C	Color control
L	Line mode flag
CI	Circle mode flag
S	Set mode flag
P	Color of pixel before cursor is moved to pixel
SC	Variable for color set selection
F	Color to set pixel after cursor moves if not in 'set' mode

Table 2. Variables

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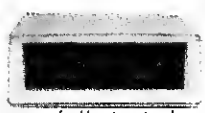

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Line	Function
5–60	Initialization
70–170	Keyboard scan routine
80	Set mode routine
85	Line mode routine
90	Circle mode routine
95	Paint mode routine
100	Color set change routine
180–190	Color set change routine
300–360	Repeat (rapid motion) cursor subroutines
400–475	Cursor single move and pixel set subroutines
500–530	Circle radius subroutines

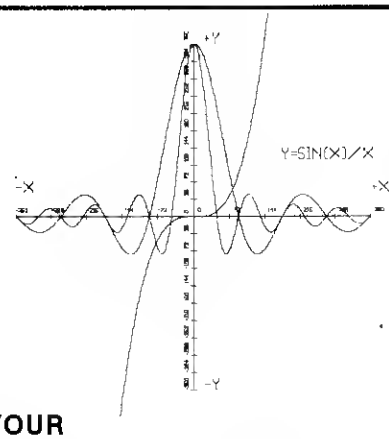
Table 3. Line Functions

Program Listing

```
5 '**"DRAW"**LARRY COLLE**JAN82*
10 POKE65495,1
20 PMODE3,1
30 PCLS
40 SCREEN1,0
50 X=128:Y=96:C=3:L=1:CI=1:S=1:F=1:R=1
60 PSET(X,Y,C)
70 A$=INKEY$
80 IFA$="S"THENS=S*-1:F=C
85 IFA$="L"THENL=L*-1:IFL=-1THENA1=X:A2=Y ELSEA3=X:A4=Y:LINE(A1,
A2)-(A3,A4),PSET:F=4
90 IFA$="C"THENCI=CI*-1:IFCI=-1THENA1=X:A2=Y ELSEGOSUB500:CIRCLE
(A1,A2),A7,C:F=C
100 IFA$="R"THENGOTO180
```

Listing continues

EPSON GRAPHICS



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```
5 '**DISPLAY**
10 PMODE3,1
20 SCREEN1,0
30 GOTO30
40 GOTONEW
```

Program Listing 2

area of the same color, change the cursor's color.

If the Paint function doesn't work, move the cursor up or down slightly to another location inside the border, and press P again.

Sometimes the program isn't in the keyboard scan routine. If the keyboard doesn't respond to a command, reenter the command.

If your circles aren't round, add a ratio factor to the circle statement in line 90. This factor changes the circle's height-to-width ratio. (I use .88 for my 19-inch Sony.) Consult your manual if you aren't familiar with this syntax.

Should the program not run on your computer, eliminate line 10. Line 10 puts the computer in the faster dual-speed mode of operation. If you use the dual-speed mode, remember to either reset your computer or POKE 65494,1 before doing any cassette tape operations.

Saving a Display

Use the CSAVEM statement to save a display on cassette tape. The syntax is CSAVEM"NAME", X,Y,Z. NAME is the name you give your display and it must be eight or fewer characters long. X is the starting memory address of the block of machine language or data you want to save. With PMODE3, 1 and with PMODE4, 1, X is 1536. Y is the end address of the block; in this case, it's 7679. Z stands for transfer, which is used by the EXEC command but isn't used here. I use a 1.

To retrieve graphics from tape, use a CLOADM statement with the drawing's name. This loads the file back into the same memory block from which it was saved. Program Listing 2 lets you display the graphics. Use the same PMODE and start page you used when creating the design. You can also load a program into the computer to use or modify the drawing. Just don't use a PCLS statement as this clears graphics memory.

PMODE4

PMODE4 creates some interesting results. With SCREEN1,0, the cursor changes between red and green as it moves horizontally. Vertical lines ap-

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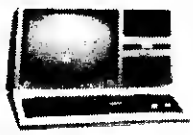

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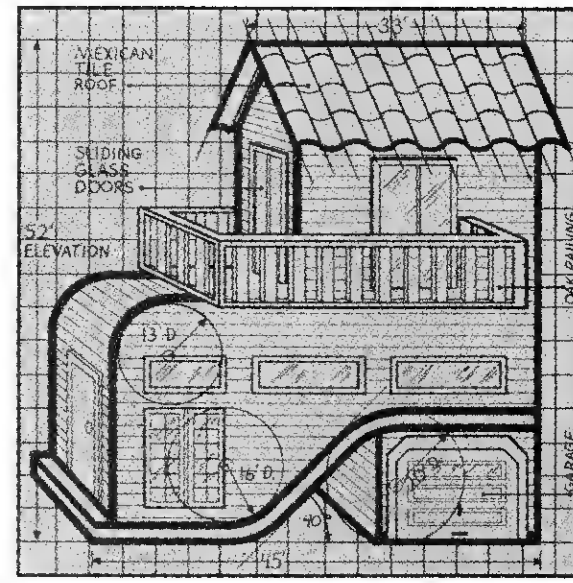
WE COULD SHOW THE OLD WOMAN WHAT TO DO WITH THE SHOE.



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pear as the color of the cursor, either bright red or green.

When you draw a series of vertical lines and move the cursor two spaces horizontally between each line, a solid block of either red or green appears. But, moving the cursor one space horizontally between each line creates a block of the normal foreground color. In effect, by manipulating the space between the vertical lines, you can create four colors in PMODE4. The Paint function only paints in the foreground color as it fills all the vertical lines with color. To use PMODE4, alter the program as indicated in Table 1.

Conclusion

You can master this program in a few minutes, and you should find it useful. I use a modified version with a stock market price program; I draw trend lines, channels, envelopes, and projected moving averages over a computer-generated stock chart. Another application might be drawing electronic circuit diagrams and saving completed circuits on tape. ■

Larry W. Colle (12101 N.W. Porter, Parkville, MO 64152) works for KCMO-TV. His hobbies include electronics and playing the guitar.

Listing continued

```
105 IFA$="1"THENC=1
110 IFA$="2"THENC=2
115 IFA$="3"THENC=3
120 IFA$="4"THENC=4
125 IFA$="P"THENPAINT(X-2,Y),C,C:F=C
130 IFA$=CHR$(9)THENGOSUB400
135 IFA$=CHR$(93)THENGOSUB300
140 IFA$=CHR$(8)THENGOSUB420
145 IFA$=CHR$(21)THENGOSUB320
150 IFA$=CHR$(10)THENGOSUB440
155 IFA$=CHR$(91)THENGOSUB340
160 IFA$=CHR$(94)THENGOSUB460
165 IFA$=CHR$(95)THENGOSUB360
170 GOTO70
180 IFSC=1THENSC=0ELSESC=1
190 SCREEN1,SC:GOTO70
300 GOSUB400
310 A$=INKEY$:IFA$=""THENGOTO300ELSERETURN
320 GOSUB420
330 A$=INKEY$:IFA$=""THENGOTO320ELSERETURN
340 GOSUB440
350 A$=INKEY$:IFA$=""THENGOTO340ELSERETURN
360 GOSUB460
370 A$=INKEY$:IFA$=""THENGOTO360ELSERETURN
400 IFX>253THENRETURNELSEP=PPOINT(X+2,Y):PSET(X+2,Y,C)
410 IFS=-1THENPSET(X,Y,C)ELSEPSET(X,Y,F)
415 X=X+2:F=P:RETURN
420 IFX<2THENRETURNELSEP=PPOINT(X-2,Y):PSET(X-2,Y,C)
430 IFS=-1THENPSET(X,Y,C)ELSEPSET(X,Y,F)
435 X=X-2:F=P:RETURN
440 IFY>190THENRETURNELSEP=PPOINT(X,Y+1):PSET(X,Y+1,C)
450 IFS=-1THENPSET(X,Y,C)ELSEPSET(X,Y,F)
455 Y=Y+1:F=P:RETURN
460 IFY<1THENRETURNELSEP=PPOINT(X,Y-1):PSET(X,Y-1,C)
470 IFS=-1THENPSET(X,Y,C)ELSEPSET(X,Y,F)
475 Y=Y-1:F=P:RETURN
500 A3=X:A4=Y
510 A5=A3-A1:A6=A4-A2
520 A5=ABS(A5):A6=ABS(A6)
530 A7=SQR((A5*A5)+(A6*A6)):A7=INT(A7):RETURN
```


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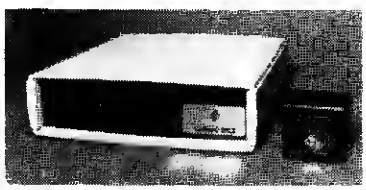

As featured in Ciarcia's Circuit Cellar Byte Magazine, March 1981

Reviewed in March '82 "80 Microcomputing"

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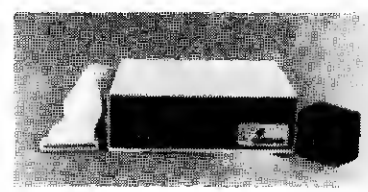

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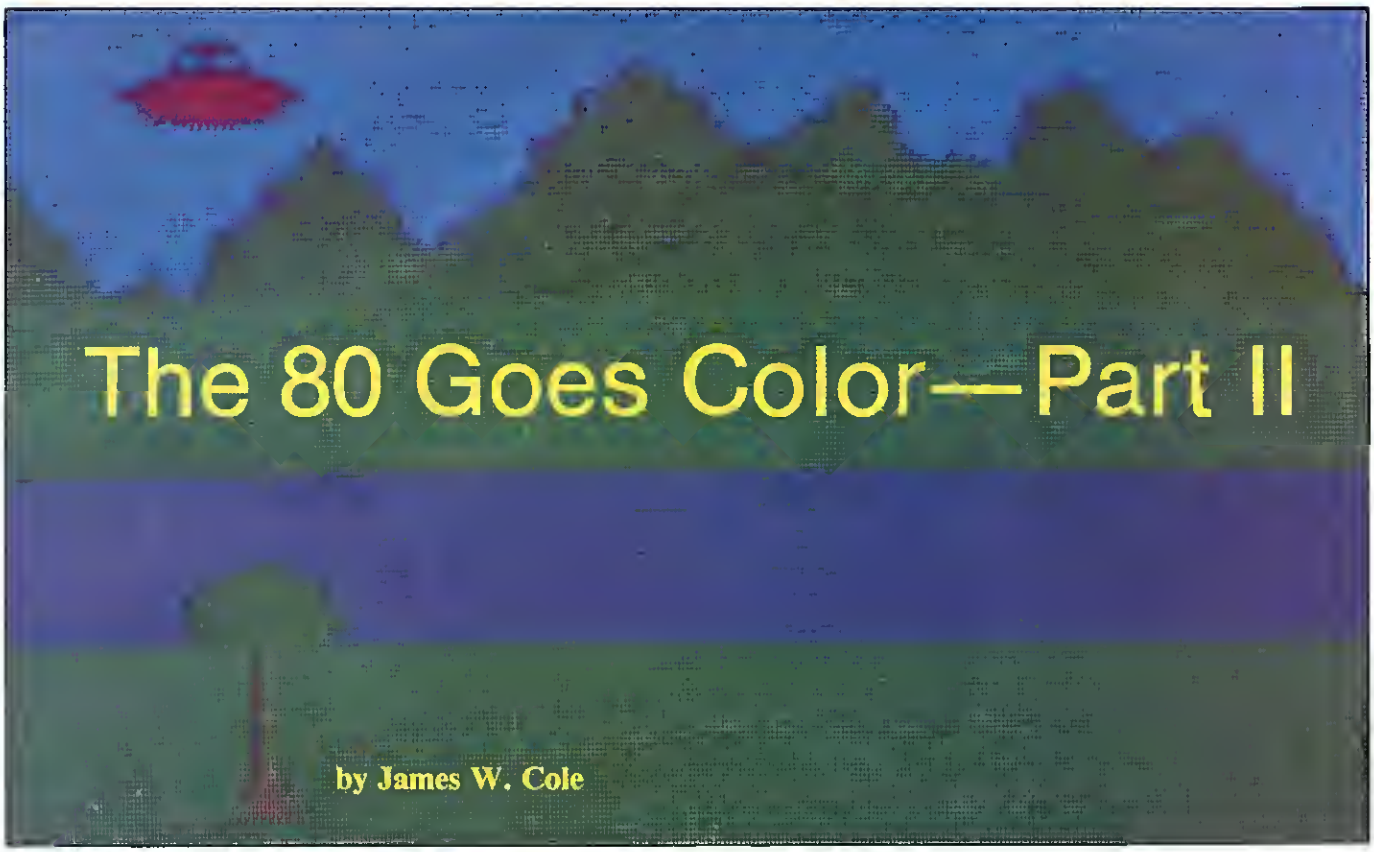

The 80 Goes Color—Part II

by James W. Cole

Now that you've modified your TRS-80 so it's capable of color graphics, you need this set of USR routines to enhance your programming.

Last month I described the hardware required to add high-resolution color graphics to the TRS-80 Models I/III. I added an interface circuit between the TRS-80 and the TMS 9918A Video Display Processor (VDP) from Texas Instruments.

The hardware works great, but the four Basic routines I used to control the Mikrokolor are crude and slow, and they require a lot of programming.

This month I'll correct these shortcomings with a set of USR routines, ten machine-language routines that you can call from Basic. Or, if you prefer, include this set as part of your Assembly-language routines.

These USR routines provide a fast, easy interface between the programmer and the TMS 9918A VDP. Before I discuss the detailed control of the VDP, I'll review the relationship between binary and hexadecimal numbers.

Bits to Bytes

In your work with computers, you will eventually need the binary, or base two, number system that uses only two digits, zero and 1. Binary numbers produce the patterns for color graphics.

A one-to-one relationship exists between four-digit binary numbers and one-digit hexadecimal (base 16) numbers (see Table 1). It's much easier to deal with a single digit than with four 1's and zeros. The letters A–F represent values greater than nine.

Two of these nibbles (4 bits) together form an 8-bit pattern equivalent to a

Binary	Hex
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	A
1011	B
1100	C
1101	D
1110	E
1111	F

Table 1. Binary/Hex Relationships

Binary	Hex
11111111	FF
10000001	81
10000001	81
10000001	81
10000001	81
10000001	81
10000001	81
11111111	FF

Table 2

Binary	Hex
00111000	38
01010100	54
10010010	92
11101110	EE
10010010	92
01010100	54
00111000	38
00000000	00

Table 3

The Key Box

Model I or III
48K RAM
Basic or Assembly Language

Program Listing 1

```
10 REM THIS IS A DEMONSTRATION PROGRAM FOR THE MIKROKOLOR INTERF
ACE
20 REM THE USR ROUTINE PACKAGE MUST BE LOADED AND THE MEMORY PRO
TECTED
30 REM THE FUNCTIONS DEFINED HERE ARE EXAMPLES OF HOW THE USR RO
UTINES CAN BE COMBINED TOGETHER TO FORM USEFUL OPERATIONS
40 REM SEVERAL DIFFERNT METHODS ARE USED TO PASS THE NECESSARY P
ARAMETERS TO THE FUNCTIONS
50 REM SELECT THE METHOD YOU PREFER AND START WRITING YOU OWN FU
NCTIONS AND PROGRAMS
60 REM ******************************************************
70 REM
80 REM               JIM COLE     1 OCT 82
90 REM
100 REM ******************************************************

110 REM THIS PROGRAM WILL DRAW A SCENE WITH A TREE, ROAD, SPACES
HIP, AND A FOREST IN THE BACKGROUND
120 REM YOU CAN MOVE THE SPACESHIP AROUND WITH THE ARROW KEYS, T
HE SPACE BAR WILL CHANGE ITS COLOR
130 DEFINT A-Z
140 REM DEFINE THE ADDRESS OF THE USR ROUTINES IN HIGH MEMORY
150 DEFUSR0=&H0F000:DEFUSR1=&H0F003:DEFUSR2=&H0F006
160 DEFUSR3=&H0F009:DEFUSR4=&H0F00C:DEFUSR5=&H0F00F
170 DEFUSR6=&H0F012:DEFUSR7=&H0F015:DEFUSR8=&H0F018
180 DEFUSR9=&H0F01B
190 REM DEFINE THE FUNCTIONS THAT TIE THE USR ROUTINES IN TO USE
FUL OPERATIONS
200 DEF FN MD(U0) = USR0(U0) : REM MODE SELECTION
210 DEF FN SS(U0) = USR1(U0) : REM SET SPRITE SIZE
220 DEF FN SP(U$,U0) = USR3(VARPTR(U$)) + USR5(U0) :
   REM SET SPRITE PATTERN TO U$ VALUE
230 DEF FN SC(U$,U0) = USR3(VARPTR(U$)) + USR7(U0) :
   REM SET SPRITE COLOR TO U$ VALUE
240 DEF FN SN(U0,U1) = USR3(U0) + USR7(-U1) :
   REM SET SPRITE NAME
250 DEF FN SL(U0,U1,U2) = USR3(U1) + USR2(U2) + USR3(U0) + USR2(
-U2) :
   REM SET SPRITE LOCATION
260 DEF FN CS(U0) = USR8(-1) : REM CLEAR ALL SPRITES
270 DEF FN CP(U0) = USR8(1)  : REM CLEAR PATTERN PLANE
280 DEF FN DP(U$,U0) = USR3(VARPTR(U$)) - USR4(U0) :
    REM DEFINE PATTERN/CHARACTER
290 DEF FN CT(U$) = USR6(VARPTR(U$)) : REM SET TEXT COLOR
300 DEF FN CG(U$,U0) = USR3(VARPTR(U$)) - USR6(U0) :
    REM SET GRAPHICS MODES PATTERN COLORS
310 DEF FN PC(U0,U1) = USR3(U0) + USR9(U1) :
    REM PRINT PATTERN/CHARACTER AT LOCATION
320 REM START OF PROGRAM LOGIC
330 U = FN MD(3) : REM SELECT GRAPHICS II MODE
340 OUT 2,11 : OUT 2,135 : REM SET BACKDROP COLOR TO LIGHT YELLO
W
350 U = FN SS(1) : REM SPRITE SIZE IS 16X16 MAG 1
360 REM SET UP THE SPRITE PATTERNS FIRST
370 A$(0) = "0000000F0F1F3F7F7F3F7F7F3F3F0F01011F7FFFFFFFFFFFFFF
FFFFFFFFFC3" : REM DEFINE SPRITES FOR TREE TOP
380 A$(1) = "F8F0FEFEFFFFFFFFFFFFFFFFFFFFFE000000000C0C0C0F0F
8F8F8F0F80800"
390 A$(2) = "030303030303030303030303030303C0C0C0C0C0C0C0C0C0C
0C0C0C0C0C0C0" : REM TREE TRUNK SPRITES
400 A$(3) = "030303030303030303070707F1F7FFFC0C0C0C0C0C0C0C0C0E
0E0E0F0F8FEFF"
410 A$(4) = "00000000000000031F7FFF7F1F0F070100071F1121217FFFFFFF
FFFFFFFFF3F00" : REM SPACE SHIP SPRITES
420 A$(5) = "E0F8888484FEFFFFFFFFFFFFFFFFC0000000000000C0F8FEF
FFEF8F0E08000"
430 REM LOAD SPRITE PATTERN INTO VRAM
440 FOR N = 0 TO 5 : U = FN SP(A$(N),N+1) : NEXT N
450 REM SET COLORS OF SPRITES
460 U = FN SC("A",1) : U = FN SC("A",2)
470 U = FN SC("2",3) : U = FN SC("2",4)
480 U = FN SC("F",5) : U = FN SC("F",6)
490 REM DEFINE SPRITE PLANES FOR PATTERNS TO BE DISPLAYED UPON
500 U = FN SN(4,1) + FN SN(3,2) + FN SN(1,3) + FN SN(2,4) + FN S
N(5,5) + FN SN(6,6)
510 REM SET SPRITE POSITIONS ON SCREEN
520 X =125 : Y = 115
530 U = FN SL(48,144,1) + FN SL(48,128,2) + FN SL(40,112,3) + FN
 SL(56,112,4) + FN SL(X,Y,5) + FN SL(X+16,Y,6)
540 REM DEFINE PATTERNS FOR PATTERN PLANE GRAPHICS
550 A$(0) = "FFFFFFFFFFFFFFFF" : REM SOLID PATTERN
560 A$(1) = "0000000000387CFE" : REM FOREST PATTERNS
570 A$(2) = "0000101C3E7E7EFF"
580 A$(3) = "0001030707 0FEFFF" : REM RIGHT SIDE OF SLOPES
590 A$(4) = "01070FEFEFFFEFFF"
600 A$(5) = "010F3FEFEFEFEFFF"
610 A$(6) = "80C0F0FCFEFEFFFF" : REM LEFT SIDE OF SLOPES
620 A$(7) = "00FCF8F8FCFEFFFF"
630 A$(8) = "8080808 0C0F0FEFF"
640 FOR N = 0 TO 8 : U = FN DP(A$(N),N+1) : NEXT : REM LOAD PATT
ERNS IN TO PATTERN TABLE
650 A$(9) = "2727272727272727" : REM COLORS FOR PATTERNS
660 FOR N = 0 TO 9 : U = FN CG(A$(9),N) : NEXT
670 REM DRAW FOREST FOR BACKGROUND
680 REM PRINT SOLID PATTERNS FIRST
690 FOR N = 0 TO 17 : READ P : U = FN PC(P,1) :NEXT
700 FOR N = 0 TO 2 : READ P1,P2 : FOR P = P1 TO P2 : U = FN PC(P
,1) : NEXT P,N
```

Listing 1 continues

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INTASM 2.1 is $39.95 for the tape version and $49.95 for disk (specify Model I or Model III). The instruction manual only is $5, refundable with purchase of the program. Include $2 postage, and California residents add 6% sales tax. VISA, MASTERCARD, and COD orders are accepted. Satisfaction is guaranteed or a full refund will be made. ↙ 55

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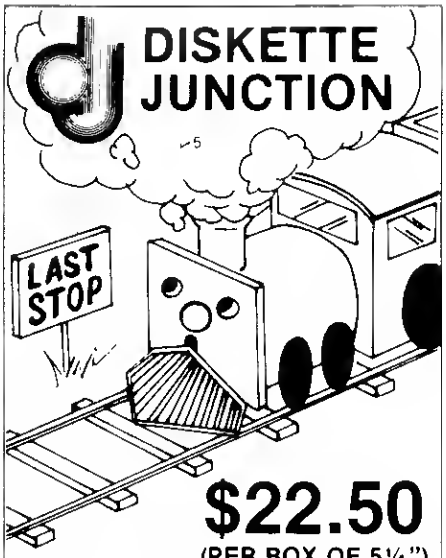

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Listing 1 continued

```
710 REM NOW FOR THE SLOPES
720 FOR N = 0 TO 31 : READ P,P1 : U = FN PC(P,P1) : NEXT N
730 U = FN DP(A$(0),512) : U = FN CG("3737373737373737",512) : R
EM SET PATTERN AND COLOR FOR LOWER 1/3 OF SCREEN
740 U = FN DP(A$(0),257) - FN CG("E3E3E3E3E3E3E3E3",257) + FN CG
("E3E3E3E3E3E3E3E3",256): REM DEFINE PATTERN AND COLOR OF GRAP
HICS BLOCK FOR ROAD
750 FOR N = 384 TO 511 : U = FN PC(N,257) : NEXT : REM PRINT GRA
PHICS CHARACTERS FOR ROAD
760 REM MOVE THE SPACE SHIP AT KEYBOARD COMMAND
770 CL = 48
780 A$ = INKEY$ : IF A$ = "" THEN 780
790 IF A$ = CHR$(8) THEN X = X - 1 : GOTO 840
800 IF A$ = CHR$(9) THEN X = X + 1 : GOTO 840
810 IF A$ = CHR$(10) THEN Y = Y + 1 : GOTO 840
820 IF A$ = CHR$(91) THEN Y = Y - 1 : GOTO 840
830 IF A$ <> " " THEN 780 ELSE CL = CL + 1 : IF CL = 71 THEN CL
= 48 ELSE  U = FN SC(CHR$(CL),5) - FN SC(CHR$(CL),6) : REM CHANG
E COLOR OF SPACE SHIP
840 U = FN SL(X,Y,5) + FN SL(X+16,Y,6)
850 GOTO780
860 DATA 160,192,193,224,225,226,168,199,200,201,111,142,143,144
,147,148,152,153 : REM INDIVIDUAL SOLID BLOCKS THAT ARE SET
870 DATA 173,188,204,221,230,254 : REM END POINTS FOR ROWS OF SO
LID GRAPHIC CHARACTERS
880 DATA 128,2,161,7,194,7.227,9,228,3,229,4,198,5,167,6,136,3,1
69,8,202,9,203,6,172,4,141,5,110,6,79,2,112,7,145,7,146,5,115,4,
116,8,149,9,150,2,151,4,120,5,121,8,154,7,155,6,156,8,189,7,222,
8,255,9
890 REM SCREEN LOCATIONS FOLLOWED BY THE PATTERN THAT IS TO BE P
RINTED IN THAT LOCATION, THESE PAIRS ARE READ BY STATEMENT 720
```

byte. A byte is stored in one address of the Z80 microprocessor in your TRS-80 memory or the TMS 9918A VRAM.

By using two hexadecimal digits to represent a pattern of eight binary digits, you reduce the work of entering values by 75 percent. The chance to make mistakes is reduced as well; 110110011 looks just like 110011011, but D3 and CB, their hex equivalents, are easy to distinguish.

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Pattern Strings

The TMS 9918A provides a 256-by-192-pixel display of 49,152 dots that you must set or reset with the VDP.

Two of the tables in the TMS 9918A use patterns of 64 pixels. The pattern table and the sprite pattern table use a set of 8 bytes to form a single 8-by-8 pixel pattern. You can think of a pixel as a binary digit; it has only two possible states, on or off. A 1 represents the on state and a zero represents the off state.

The best way to understand how to convert a pixel pattern to hex digits is with an example. Table 2 shows how to form a square, and hex values for the user routine inputs. The first row has all 1's in it, the next six rows have a 1 in the first and last columns, and the last row has all 1's. You can represent this pattern with 16 hex digits (FF818181818181FF) instead of 64 bits (1111111100000011 0000001100000011000000110000001 1000000111111111).

Since USR routines require patterns defined as hex values, you need to understand this process to define your own patterns. One more example is your favorite laser cannon sight. The laser sight is defined by the string 385492EE92543800. When this string passes to the USR routines, it loads the pixel pattern shown in Table 3.

Graph paper helps you design patterns. Take a piece of graph paper, mark off an 8-by-8-character area and color in the 1's and zeros until you find a pleasing combination. Graph paper is

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(outline #1 in a series)

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TMS 9918 User Routines
SN = Sprite Number SP = Sprite Position
SL = Screen Location PN = Pattern Number

To set mode
Text A = USR0 (0)
Multicolor A = USR0 (1)
Graphics I A = USR0 (2)
Graphics II A = USR0 (3)

To set sprite size
8×8 MAG 1 A = USR1 (0)
16×16 MAG 1 A = USR1 (1)
8×8 MAG 2 A = USR1 (2)
16×16 MAG 2 A = USR1 (3)

Define sprite pattern
A$ = "FFFFFFFFFFFFFFFF"
A = USR3 (VARPTR (A$))
A = USR5 (SN)

Set sprite color
A$ = "F"
A = USR3 (VARPTR (A$))
A = USR7 (SN)

Set sprite name (Pattern #)
A = USR3 (PN)
A = USR7 (−SN)

Sprite position
Vertical
A = USR3 (SP)
A = USR2 (SN)
Horizontal
A = USR3 (SP)
A = USR2 (−SN)

Clear sprites
A = USR8 (−1)

Clear pattern plane
A = USR8 (1)

Define pattern/character
A$ = "FFFFFFFFFFFFFFFF"
A = USR3 (VARPTR (A$))
A = USR4 (PN)

Define colors for patterns/text
Text
A$ = "FF"
A = USR6 (VARPTR (A$))
Multicolor
A$ = "FFFF"
A = USR3 (VARPTR (A$))
A = USR6 (PN)
Graphics I
A$ = "FF"
A = USR3 (VARPTR (A$))
A = USR6 (PN)
Graphics II
A$ = "FFFFFFFFFFFFFFFF"
A = USR3 (VARPTR (A$))
A = USR6 (PN)

Print char/pattern at location
A = USR3 (SL)
A = USR9 (PN)

Note: If locations are sequential, it is not necessary to load the screen location every time. The program will automatically increment the location.

especially helpful in visualizing sprites, text characters, and graphics.

USR Routines

The set of 10 USR routines I have defined provides control over most of the functions of the TMS 9918A. Table 4 shows the calling sequence for each operation you might want to perform. All hex string values are filled with F's; you will replace these values with your own strings.

The VARPTR function passes strings to the USR routines. More information on this function is in your Basic manual. Now take a closer look at each of these USR routines.

USR0 selects the mode of operation for the TMS 9918A, clears the pattern plane, clears all sprites, and sets default colors for the background and pattern planes.

USR1 selects pattern size of sprites (8-by-8-character or 16-by-16-character), and selects the magnification factor of sprites *1 or *2.

USR2 updates sprite location on the screen. If you call USR2 with a positive sprite number, update the vertical coordinate. If you call it with a negative sprite number, update the horizontal coordinate. You must load the value of the coordinate into a temporary location by calling USR3.

USR3 temporarily stores values to be used by another routine. These values can be a pattern number, a pointer to a string, or even a two-character string itself.

USR4 loads a pattern into the pattern table. The pattern number is passed in the USR4 call. A pointer to the string of 16 hex digits that is to be loaded into the pattern table is in the temporary value of USR3.

USR5 loads a pattern into the sprite pattern table. This routine performs the same function for sprites as USR4 does for the pattern plane, except that the sprites can be either 16 hex digits or 64 hex digits depending on the sprite size selected in USR2.

USR6 sets the colors for the various modes. For text, the color string for the background and character color are passed directly in the USR6 call. For multicolor, the color string is passed through USR3, and the pattern number is passed in the USR6 call. Graphics I and graphics II are identical to multicolor except for the length of the string.

USR7 serves two purposes. If you call it with a positive sprite number, it sets the color of the sprite to the value pointed to by the USR3 temporary variable. If you call USR7 with a negative

sprite number, it sets the name of the sprite to the value in the USR3 temporary variable.

USR8 also serves two purposes. If you call it with a positive value, it sets the entire pattern plane to pattern zero. This clears the screen if pattern zero is defined as all zeros or all 1's. If you call USR8 with a negative value, it turns off all sprite processing (clearing all sprites).

USR9 prints a pattern at a particular location on the screen that is passed in USR3 and is automatically incremented for sequential operation. The pattern number is passed in the USR9 call.

Basic Functions

One of the easiest ways to call these USR routines is by defining a set of functions at the beginning of a Basic program.

Functions allow you to call a set of USR routines in a sequence with only one statement. These functions should be defined near the beginning of your program, just after you define the USR-routine starting locations. You should order your program as follows:

- Variable declarations, including type definitions and array declarations
- USR routine addresses defined
- Functions defined
- Basic program logic
- End of program

Program Listing 1 shows the use of Basic functions.

Options

This program runs on a machine with 48K of memory. With minor changes, it runs on a 32K or 16K machine. You need to change the origin statement to a lower address and the USR routine addresses to the new memory locations. Answer the memory-size question for a 48K machine with 61440.

You can also use these programs in your own routines to control the TMS 9918A. I have included a few elementary functions that let you read/write the VRAM of the TMS 9918A, write to the control register, and read the status register.

These are the same four Basic operations shown last month but they are now in Assembly language. The rest of the program uses these routines to perform the operations requested by the USR routine.

Finished?

The hardware and software are both complete, and your TRS-80 can draw high-resolution color graphics. However, you still have games and 3D graphics packages to write. You could use the 16K of VRAM as a printer buffer with the right software to drive it. You don't even have a character set defined for the text mode yet.

This project has just begun. Look for more programs for the Mikrokolor interface in the future, some from me and possibly some from other users who have new applications. ■

James Cole can be reached at 515 Aspen St., Vandenberg, CA 93437.

Program Listing 2

```
                00100 ;*********************************************************
                00110 ;***                                                   ***
                00120 ;***          9918A USER ROUTINES                      ***
                00130 ;***              JIM COLE                             ***
                00140 ;***            12 AUG 1982                            ***
                00150 ;***                                                   ***
                00160 ;*********************************************************
                00170 ;  JUMP TABLE TO ALL 10 USR ROUTINES TO BE CALLED
                FROM BASIC
F000            00180           ORG     0F000H  ; START OF USR PROGRAMS
F000 C31EF0     00190 USR0      JP      USER0
F003 C364F1     00200 USR1      JP      USER1
F006 C3A0F1     00210 USR2      JP      USER2
F009 C3D7F1     00220 USR3      JP      USER3
F00C C3E0F1     00230 USR4      JP      USER4
F00F C357F2     00240 USR5      JP      USER5
F012 C38BF2     00250 USR6      JP      USER6
F015 C3E3F2     00260 USR7      JP      USER7
F018 C336F3     00270 USR8      JP      USER8
F01B C36DF3     00280 USR9      JP      USER9
                00290 ;
                00300 ;
                00310 ;  USR0  DEFINE MODE OF OPERATION AND CLEAR SCREEN
                00320 ;
                00330 ;         0= TEXT , 1 = MULTICOLOR , 2 = GRAPHICS I
                00340 ;         3 = GRAPHICS II
                00350 ;         CLEAR SCREEN AND ALL SPRITES
                00360 ;
F01E CD7F0A     00370 USER0     CALL    0A7FH   ;LOAD VALUE INTO HL
F021 3E10       00380           LD      A,16    ;ENABLE I/O BUS FOR MODEL III
F023 D3EC       00390           OUT     (236),A
```

Listing 2 continues

What do people who've used the NEW amber or green replacement CRT's say about them?

"I just purchased one of your Soft-View CRT's and I wanted to tell you how much I like it...

"Owning one of your CRT's blows all the other green-screen products away. With the non-glare surface on the tube, I could even throw away my old Radio Shack glare mask.

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Walter Coe
Tampa, Florida

From unsolicited letters of testimonial, reprinted with permission

"I've just received and installed my GN42G cathode-ray tube. To say the least, I am impressed! Its operation is everything that you represented in your advertisement and then some. It is now a real pleasure to program my computer for hours on end without getting the side effects from the flickering display of the old CRT.

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Galen S. Casey
Clovis, California

From unsolicited letters of testimonial, reprinted with permission

LSIS's NEW SOFT-VIEW REPLACEMENT CRT

FOR THE FULL STORY SEE PAGE 43

Langley-St.Clair Instrumentation Systems, Inc.
132 West 24th St., NY, NY 10011
1-800-221-7070

See List of Advertisers on Page 339

Listing 2 continued

```
F025 AF       00400          XOR     A       ;CLEAR A REGISTER
F026 B5       00410          OR      L       ;LOAD A REG WITH VALUE
F027 32FDF0   00420          LD      (MODE),A
F02A 280C     00430          JR      Z,TEXT
F02C 3D       00440          DEC     A
F02D 2820     00450          JR      Z,MULTI
F02F 3D       00460          DEC     A
F030 2837     00470          JR      Z,GRP1
F032 3D       00480          DEC     A
F033 284E     00490          JR      Z,GRP2
F035 C3CAF0   00500          JP      ERROR
              00510 ;SET UP TEXT MODE REGISTERS
              00520 ;CLEAR THE SCREEN
              00530 ;
F038 21FEF0   00540 TEXT     LD      HL,REGTBL       ;SET POINTER TO REGISTER TAB
LE
F03B 3E00     00550          LD      A,0             ;REGISTER VALUE OF ZERO
F03D 77       00560          LD      (HL),A          ;LOAD INTO REGISTER TABLE
F03E 23       00570          INC     HL              ;NEXT REGISTER
F03F 3ED2     00580          LD      A,0D2H          ;REGISTER 1 VALUE
F041 77       00590          LD      (HL),A          ;LOAD INTO REGISTER TABLE
F042 CDA0F0   00600          CALL    RGSET1          ;SET REMAINING REGISTERS
F045 CDEEF0   00610          CALL    REGLD           ;LOAD REGISTERS INTO VDP
F048 CD06F1   00620          CALL    TCLR            ;CLEAR SCREEN
F04B CD4CF3   00630          CALL    CLS
F04E C9       00640          RET
              00650 ;SET UP REGISTERS FOR MULTICOLOR MODE
              00660 ;AND CLEAR THE SCREEN
              00670 ;
F04F 21FEF0   00680 MULTI    LD      HL,REGTBL       ;SET POINTER TO REGISTER TAB
LE
F052 3E00     00690          LD      A,0             ;REGISTER ZERO VALUE
F054 77       00700          LD      (HL),A          ;LOAD INTO REGISTER TABLE
F055 23       00710          INC     HL              ;NEXT REGISTER
F056 3ECA     00720          LD      A,0CAH          ;REGISTER 1 VALUE
F058 77       00730          LD      (HL),A          ;STORE REGISTER 1 VALUE
F059 CDA0F0   00740          CALL    RGSET1          ;SET REMAINING REGISTERS
F05C CDEEF0   00750          CALL    REGLD           ;LOAD REGISTERS
F05F CD06F1   00760          CALL    MCMCLR          ;DEFINE CLS CHAR
F062 CD4CF3   00770          CALL    CLS             ;CLEAR SCREEN
F065 CD3DF3   00780          CALL    CLRSPR          ;CLEAR ALL SPRITES
F068 C9       00790          RET
              00800 ;
              00810 ;DEFINE REGISTER VALUES FOR GRAPHICS 1 MODE
              00820 ;AND CLEAR THE SCREEN
              00830 ;
F069 21FEF0   00840 GRP1     LD      HL,REGTBL       ;SET POINTER TO REGISTER TAB
LE
F06C 3E00     00850          LD      A,0             ;REGISTER ZERO VALUE
F06E 77       00860          LD      (HL),A          ;STORE REGISTER 0
F06F 23       00870          INC     HL              ;NEXT REGISTER
F070 3EC2     00880          LD      A,0C2H          ;REGISTER 1 VALUE
F072 77       00890          LD      (HL),A          ;STORE REG 1
F073 CDA0F0   00900          CALL    RGSET1
F076 CDEEF0   00910          CALL    REGLD           ;LOAD REGISTER INTO VDP
F079 CD14F1   00920          CALL    G1CLR           ;DEFINE 0 CHAR
F07C CD4CF3   00930          CALL    CLS             ;CLEAR SCREEN
F07F CD3DF3   00940          CALL    CLRSPR          ;CLEAR ALL SPRITES
F082 C9       00950          RET
              00960 ;
              00970 ;GRAPHICS 2 MODE REGISTERS DEFINED
              00980 ;AND SCREEN CLEARED
              00990 ;
F083 21FEF0   01000 GRP2     LD      HL,REGTBL       ;POINTER TO REGISTER TABLE
F086 3E02     01010          LD      A,2             ;REG 0 VALUE
F088 77       01020          LD      (HL),A          ;STORE INTO REG TABLE
F089 23       01030          INC     HL              ;NEXT REGISTER
F08A 3EC2     01040          LD      A,0C2H          ;REG 1 VALUE
F08C 77       01050          LD      (HL),A          ;STORE REG 1 VALUE
F08D CDA0F0   01060          CALL    RGSET1          ;SET REMAINING REGISTERS
F090 CDB9F0   01070          CALL    RGSET2          ;SET MSB OF REGISTERS
F093 CDEEF0   01080          CALL    REGLD           ;LOAD VDP REGISTERS
F096 CD27F1   01090          CALL    G2CLR
F099 CD4CF3   01100          CALL    CLS             ;CLEAR SCREEN
F09C CD3DF3   01110          CALL    CLRSPR          ;CLEAR SPRITES
F09F C9       01120          RET
              01130 ;
              01140
              01150
              01160
              01170 ;
              01180 ;SET UP REGISTER TABLE REG 2-7 FOR TEXT,MULTI & GRP1
              01190 ;
F0A0 23       01200 RGSET1   INC     HL              ;NEXT REGISTER
F0A1 3E0F     01210          LD      A,NTBA          ;LOAD NAME TABLE BASE ADDR
F0A3 77       01220          LD      (HL),A          ;LOAD INTO REGISTER TABLE
F0A4 23       01230          INC     HL              ;NEXT REGISTER
F0A5 3EFF     01240          LD      A,CTBA          ;LOAD COLOR TABLE BASE ADDR
F0A7 77       01250          LD      (HL),A          ;LOAD INTO REGISTER TABLE
F0A8 23       01260          INC     HL              ;NEXT REGISTER
F0A9 3E00     01270          LD      A,PGBA          ;LOAD PATTERN GENERATOR BASE
 ADDR
F0AB 77       01280          LD      (HL),A          ;LOAD INTO REGISTER TABLE
F0AC 23       01290          INC     HL              ;NEXT REGISTER
F0AD 3E70     01300          LD      A,SATBA         ;LOAD SPRITE ATTRITIBUE TABL
E BASE ADDR
F0AF 77       01310          LD      (HL).A          ;LOAD INTO REGISTER TABLE
F0B0 23       01320          INC     HL              ;NEXT REGISTER
F0B1 3E03     01330          LD      A,SGBA          ;LOAD SPRITE GENERATOR BASE
ADDR
F0B3 77       01340          LD      (HL),A          ;STORE IN REGISTER TABLE
F0B4 23       01350          INC     HL              ;NEXT REGISTER
F0B5 3E83     01360          LD      A,COLOR0        ;LOAD DEFAULT COLORS
F0B7 77       01370          LD      (HL),A          ;LOAD INTO REGISTER TABLE
F0B8 C9       01380          RET
              01390 ;
              01400 ;SET LSB'S FOR GRAPHICS 2 MODE
              01410 ;
F0B9 3A01F1   01420 RGSET2   LD      A,(REG3)
F0BC F67F     01430          OR      7FH
F0BE 3201F1   01440          LD      (REG3),A
F0C1 3A02F1   01450          LD      A,(REG4)
F0C4 F603     01460          OR      3H
F0C6 3202F1   01470          LD      (REG4),A
F0C9 C9       01480          RET
              01490 ;
              01500 ;GENERAL ERROR ROUTINE
              01510 ;
F0CA 21DBF0   01520 ERROR    LD      HL,ERMSG
F0CD 0613     01530          LD      B,ERMSGL
F0CF 7E       01540 LOOP2    LD      A,(HL)
F0D0 23       01550          INC     HL
F0D1 E5       01560          PUSH    HL
F0D2 C5       01570          PUSH    BC
F0D3 CD3300   01580          CALL    33H
F0D6 C1       01590          POP     BC
F0D7 E1       01600          POP     HL
F0D8 10F5     01610          DJNZ    LOOP2
F0DA C9       01620          RET
F0DB 43       01630 ERMSG    DEFM    'COLOR ROUTINE ERROR'
     4F 4C 4F 52 20 52 4F 55
     54 49 4E 45 20 45 52 52
     4F 52
0013          01640 ERMSGL   EQU     $-ERMSG
              01650 ;
              01660 ;LOAD VDP REGISTER FROM REGISTER TABLE
              01670 ;
F0EE 2105F1   01680 REGLD    LD      HL,REGTBL+7     ;SET POINTER
F0F1 0E07     01690          LD      C,7             ;SET REGISTER COUNTER
F0F3 7E       01700 LOOP1    LD      A,(HL)          ;GET VALUE FROM TABLE
```

Listing 2 continues

The Original Magazine for Owners of the TRS-80™ MicroComputer

MODEL I • MODEL II/16 • MODEL III • POCKET COMPUTER • COLOR COMPUTER

Software for TRS-80 Owners

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Listing 2 continued

```
F0F4 CDA6F3   01710          CALL    WRTREG          ;SEND TO VDP REGISTER
F0F7 2B       01720          DEC     HL              ;NEXT REGISTER
F0F8 0D       01730          DEC     C               ;NEXT REGISTER
F0F9 F2F3F0   01740          JP      P,LOOP1         ;LAST REG?
F0FC C9       01750          RET
              01760 ;
              01770 ;STORAGE LOCATIONS
              01780 ;
F0FD 00       01790 MODE     DEFB    0       ;MODE FLAG
F0FE 00       01800 REGTBL   DEFB    0       ;REG 0
F0FF 00       01810 REG1     DEFB    0       ;REG 1
F100 00       01820 REG2     DEFB    0       ;REG2
F101 00       01830 REG3     DEFB    0
F102 00       01840 REG4     DEFB    0
F103 00       01850 REG5     DEFB    0
F104 00       01860 REG6     DEFB    0
F105 00       01870 REG7     DEFB    0
              01880 ;
              01890 ;VALUES USED IN THESE ROUTINES
              01900 ;
000F          01910 NTBA     EQU     15D     ;NAME TABLE BASE ADDRESS
00FF          01920 CTBA     EQU     255D    ;COLOR TABLE BASE ADDRESS
0000          01930 PGBA     EQU     0       ;PATTERN GENERATOR BASE ADDRESS
0070          01940 SATBA    EQU     112D    ;SPRITE ATTRITIBUE TABLE BASE ADDR
0003          01950 SGBA     EQU     3D      ;SPRITE GENERATOR BASE ADDRESS
0083          01960 COLOR0   EQU     83H     ;BLACK ON MED GREEN
              01970 ;
              01980 ;CLEAR CHARACTER PATTERN AND COLOR 0
              01990 ;
F106 2600     02000 TCLR     LD      H,PGBA          ;LOAD PATTERN GENERATOR BASE
 ADDR
F108 CB24     02010          SLA     H
F10A CB24     02020          SLA     H
F10C CB24     02030          SLA     H
F10E 2E00     02040          LD      L,0             ;FORM ADDR OF PATTERN 0
F110 CD58F1   02050          CALL    MODEX           ;LOAD PATTERN OF 0'S
F113 C9       02060          RET
F106          02070 MCMCLR   DEFL    TCLR
F114 CD06F1   02080 G1CLR    CALL    TCLR
F117 26FF     02090          LD      H,CTBA          ;ZERO OUT COLOR TABLE
F119 2E00     02100          LD      L,0
F11B CB3C     02110          SRL     H
F11D CB1D     02120          RR      L
F11F CB3C     02130          SRL     H
F121 CB1D     02140          RR      L
F123 CD50F1   02150          CALL    MODEX           ;LOAD ZEROS INTO TABLE
F126 C9       02160          RET
F127 CD14F1   02170 G2CLR    CALL    G1CLR
F12A 3E00     02180          LD      A,PGBA
F12C CD38F1   02190          CALL    ZEROY           ;ZERO PATTERN IN SECOND TWO
BLOCKS
F12F 3EFF     02200          LD      A,CTBA          ;LOAD COLOR TABLE BASE ADDR
F131 07       02210          RLCA
F132 07       02220          RLCA
F133 07       02230          RLCA
F134 CD38F1   02240          CALL    ZEROY
F137 C9       02250          RET
F138 E604     02260 ZEROY    AND     4D
F13A CB27     02270          SLA     A
F13C CB27     02280          SLA     A
F13E CB27     02290          SLA     A
F140 67       02300          LD      H,A
F141 2E00     02310          LD      L,0
F143 E5       02320          PUSH    HL              ;DO FIRST BLOCK OF GRAPHICS
F144 CD58F1   02330          CALL    MODEX
F147 E1       02340          POP     HL
F148 110000   02350          LD      DE,2048D        ;CONSTANT BETWEEN SCREEN BLO
CKS
F14B 19       02360          ADD     HL,DE           ;FORM ADDR FOR SECOND BLOCK
F14C E5       02370          PUSH    HL
F14D D5       02380          PUSH    DE              ;SAVE FOR NEXT BLOCK
F14E CD58F1   02390          CALL    MODEX           ;ZERO CHARACTER
F151 D1       02400          POP     DE
F152 E1       02410          POP     HL
F153 19       02420          ADD     HL,DE           ;FORM ADDR FOR THIRD BLOCK
F154 CD58F1   02430          CALL    MODEX           ;ZERO CHARACTER
F157 C9       02440          RET
F158 1E00     02450 MODEX    LD      E,0
F15A 0607     02460          LD      B,7
F15C CDAEF3   02470          CALL    WRTRAM
F15F D301     02480 CZERO    OUT     (1),A
F161 10FC     02490          DJNZ    CZERO
F163 C9       02500          RET
              02510 ;
              02520 ;*****************************************************
              02530 ;
              02540 ;USR1 SET SPRITE SIZE
              02550 ;0 = (8X8)*1
              02560 ;1 = (16X16)*1
              02570 ;2 = (8X8)*2
              02580 ;3 = (16X16)*2
              02590 ;
F164 CD7F0A   02600 USER1    CALL    0A7FH           ;LOAD VALUE INTO HL
F167 AF       02610          XOR     A               ;CLEAR A REG
F168 B5       02620          OR      L               ;LOAD A REG WITH VALUE
F169 329FF1   02630          LD      (SPRTSZ),A      ;SAVE SPRITE SIZE
F16C 280C     02640          JR      Z,SMALL1        ; (8X8)*1
F16E 3D       02650          DEC     A
F16F 2810     02660          JR      Z,BIG1          ;(16X16)*1
F171 3D       02670          DEC     A
F172 2814     02680          JR      Z,SMALL2        ; (8X8)*2
F174 3D       02690          DEC     A
F175 281A     02700          JR      Z,BIG2          ;(16X16)*2
F177 C3CAF0   02710          JP      ERROR
F17A 3AFFF0   02720 SMALL1   LD      A,(REG1)        ;GET REGISTER THAT CONTROLS
SPRITE SIZE
F17D E6FC     02730          AND     0FCH            ;MASK OFF SIZE BITS
F17F 1815     02740          JR      SIZELD          ;LOAD REGISTER
F181 3AFFF0   02750 BIG1     LD      A,(REG1)
F184 E6FE     02760          AND     0FEH            ;MASK OFF MAGNIFICATION BIT
F186 180E     02770          JR      SIZELD          ;LOAD REGISTER
F188 3AFFF0   02780 SMALL2   LD      A,(REG1)
F18B E6FD     02790          AND     0FDH            ;MASK OFF BIG BIT
F18D F601     02800          OR      1               ;SET MAGNIFICATION BIT
F18F 1805     02810          JR      SIZELD          ;LOAD REGISTER
F191 3AFFF0   02820 BIG2     LD      A,(REG1)        ;GET REGISTER
F194 F603     02830          OR      3H              ;SET BIG AND MAG BITS
F196 32FFF0   02840 SIZELD   LD      (REG1),A        ;SAVE REGISTER LOAD
F199 0E01     02850          LD      C,1             ;SET REGISTER NUMBER
F19B CDA6F3   02860          CALL    WRTREG          ;LOAD VDP REGISTER
F19E C9       02870          RET
F19F 00       02880 SPRTSZ   DEFB    0               ;SPRITE SIZE INDICATOR
              02890 ;
              02900 ;*****************************************************
              02910 ;
              02920 ;USR2  UPDATE SPRITE LOCATION
              02930 ;SPRITE NUMBER IS PASSED IN USR2 CALL
              02940 ;+ IS VERTICAL
              02950 ;- IS HORIZONTAL POSITION UPDATE
              02960 ;THE COORDINATE HAS BEEN LOADED INTO TEMP BY USR3 CALL
              02970 ;  SPRITES ARE NUMBERED 1-32 TO PREVENT AN -0 PROBLEM
              02980 ;
F1A0 CD7F0A   02990 USER2    CALL    0A7FH           ;LOAD HL WITH CALL VALUE
F1A3 7C       03000          LD      A,H             ;TEST FOR ZERO SPRITE NUMBER

F1A4 B5       03010          OR      L
F1A5 CACAF0   03020          JP      Z,ERROR
F1A8 CB7C     03030          BIT     7,H             ;NEGATIVE?
F1AA 200D     03040          JR      NZ,HORZ         ;IS IT A VERTICAL OR HORZ
F1AC 7D       03050          LD      A,L             ;GET LSB
```

Listing 2 continues

from HOWE SOFTWARE

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SPECIFY TRS-80™ MODEL I OR MODEL III

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Enables your TRS-80 to be used as a data communications terminal to a time-sharing system, computer bulletin board, or another computer, via the RS-232-C interface.

- MEMORY BUFFER holds data for transmission or data received from other computer.
- CASSETTE or DISK may be used to load or save data from memory.
- AUTOMATIC TRANSMISSION of data from memory.
- AUTOMATIC STORAGE of incoming data at user's option.
- TRANSMIT or RECEIVE WITH VERIFICATION options included for communication between two TRS-80s using Smart Terminal.
- Full CONTROL KEYS, including control key mapping into any ASCII character. True BREAK key. Lower case supported on Model I.
- Buffered LINE PRINTER ECHO for incoming data.
- Disk and cassette files fully compatible with ELECTRIC PENCIL™ and SCRIPSIT™ programs.
- BAUD RATE and RS-232-C CHARACTERISTICS can be reset from within the program.
- SAVE PROGRAM option creates "personalized" back-up copy of program with all options set as specified by user.
- ONE PROGRAM supports both cassette and disk systems. Program is compatible with PMC-80 and other TRS-80 "work alike" computers.

Model I or III Version — **supplied on cassette $69.95**, **supplied on diskette $74.95**

Model II (CP/M) Version — **$79.95**

MON-3 and MON-5

Monitor Programs #3 and #5 are powerful utility programs which enable you to interact directly with the TRS-80 in machine language. They are useful both for beginners and for advanced programmers.

- BEGINNERS can learn to use machine language.
- COMPLETE instruction manual.
- SIMPLE commands, easy to use.

Both MON-3 and MON-5 contain the following features:

- DISPLAY memory in ASCII and hexadecimal form.
- DISASSEMBLE memory to see machine language commands.
- MOVE and COMPARE blocks.
- SEARCH through memory to find specific values.
- MODIFY memory in different ways.
- RELOCATE object programs.
- READ and WRITE object tapes in SYSTEM format.
- UNLOAD programs in low RAM on disk.
- CREATE SYMBOLIC CASSETTES of disassembled output for use as input to EDTASM program (MON-3 only).
- PRINT output optionally on video display or line printer.

Monitor #5 adds the following features:

- SAVE and LOAD disk files.
- INPUT and OUTPUT of disk sectors, bypassing disk operating system.
- RS-232-C COMMANDS for terminal mode, send and receive data.
- COMPLETE DEBUGGING PACKAGE including setting and displaying registers, single stepping, setting breakpoints and executing machine instructions.

Available for Model I and III Level II computers (16K, 32K and 48K).

Specify TRS-80™ Model I or III

MON-3 (for cassette systems) $39.95
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MAILING LIST

Maintains mailing lists of up to 1326 names (48K version). Add, change, delete, or find names. Machine language sort according to information in ANY field (first or last name, address, city, state, zip code). Three or four line labels printed in 1, 2, 3, or 4 columns, in master list, or on video display.

TRS-80 Model 1/3 Disk Version $69.95
IBM PC Disk Version $79.95

HOME BUDGET

Keeps track of your monthly and year-to-date income and expenses. Income and expenses classified by code numbers for identification of categories. Data includes date, code number, amounts and check number (optional). Computes monthly and year-to-date summaries showing income tax deductions. All output printed on video display or line printer at user's option. Complete instructions for customizing to suit your own budget.

TRS-80 Model 1/3 Cassette Version $29.95
TRS-80 Model 1/3 Disk Version $49.95
IBM PC Disk Version $59.95

SMALL BUSINESS ACCOUNTING

Based on Dome Bookkeeping Record #612, this program keeps track of income, expenditures, and payroll for a small business. Receipts and expenditures can be entered on a daily, weekly, or monthly basis. Program computes monthly, through last month, and year to date summaries. Payroll section (included in disk version only) keeps record of employees and paychecks with up to six categories of payroll deductions. Computes employee payroll records and year-to-date payroll totals. Complete instructions for customizing to suit your own business.

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Listing 2 continued

```
F1AD 3D        03060          DEC     A               ;CORRECT OFF BY ONE FOR -0 P
ROB
F1AE CDC9F1    03070          CALL    SPRLOC          ;GET SPRITE VRAM ADDRESS
F1B1 ED5BDEF1  03080          LD      DE,(TEMP)       ;GET VERT POSITION
F1B5 CDAEF3    03090          CALL    WRTRAM          ;WRITE TO VRAM
F1B8 C9        03100          RET
F1B9 7D        03110 HORZ     LD      A,L             ;GET LSB
F1BA ED44      03120          NEG                     ;CONVERT NEG TO POS VALUE
F1BC 3D        03130          DEC     A               ;CORRECT OFF BY ONE FOR -0 P
ROB
F1BD CDC9F1    03140          CALL    SPRLOC          ;GET SPRITE LOCATION
F1C0 23        03150          INC     HL              ;SET POINTER TO HORZ BYTE
F1C1 ED5BDEF1  03160          LD      DE,(TEMP)       ;GET HORZ POSITION
F1C5 CDAEF3    03170          CALL    WRTRAM
F1C8 C9        03180          RET
F1C9 6F        03190 SPRLOC   LD      L,A             ;LOAD SPRITE #
F1CA 2670      03200          LD      H,SATBA         ;ATTRITIBUTE TABLE
F1CC CB25      03210          SLA     L
F1CE CB25      03220          SLA     L
F1D0 CB25      03230          SLA     L
F1D2 CB0C      03240          RRC     H
F1D4 CB1D      03250          RR      L
F1D6 C9        03260          RET
               03270 ;
               03280 ;*****************************************************
               03290 ;
               03300 ;USR3 LOAD VALUE TO BE USED LATER
               03310 ;
F1D7 CD7F0A    03320 USER3    CALL    0A7FH           ;LOAD HL VALUE
F1DA 22DEF1    03330          LD      (TEMP),HL       ;SAVE FOR LATER USE
F1DD C9        03340          RET
F1DE 0000      03350 TEMP     DEFW    0
               03360 ;
               03370 ;*****************************************************
               03380 ;
               03390 ;USR4 SET PATTERN
               03400 ;PATTERN # IS PASSED IN USR4
               03410 ;PATTERN # = (0-767) G2  :(0-255) ALL OTHER MODES
               03420 ;USR3 TEMP IS THE VARPTR TO A STRING THAT DEFINES THE PATTER
N
               03430 ;
F1E0 CD7F0A    03440 USER4    CALL    0A7FH           ;LOAD PATTERN #
F1E3 3AFDF0    03450          LD      A,(MODE)        ;GET MODE
F1E6 B7        03460          OR      A               ;TEST FOR 0
F1E7 280C      03470          JR      Z,PTEXT         ;TEXT PATTERN
F1E9 3D        03480          DEC     A
F1EA 2809      03490          JR      Z,PTEXT         ;MULTICOLOR PATTERN IS THE S
AME
F1EC 3D        03500          DEC     A
F1ED 2806      03510          JR      Z,PTEXT         ;GRP1 PATTERN IS THE SAME AL
SO
F1EF 3D        03520          DEC     A
F1F0 2812      03530          JR      Z,PGRP2
F1F2 C3CAF0    03540          JP      ERROR
F1F5 3E00      03550 PTEXT    LD      A,PGBA          ;SET UP VRAM ADDRESS
F1F7 CB27      03560          SLA     A
F1F9 CB27      03570          SLA     A
F1FB CB27      03580          SLA     A
F1FD 29        03590          ADD     HL,HL
F1FE 29        03600          ADD     HL,HL
F1FF 29        03610          ADD     HL,HL
F200 B4        03620          OR      H
F201 67        03630          LD      H,A
F202 180F      03640          JR      PATOUT
F204 3E00      03650 PGRP2    LD      A,PGBA          ;SET UP VRAM ADDRESS
F206 CB27      03660          SLA     A
F208 CB27      03670          SLA     A
F20A E620      03680          AND     20H
F20C 29        03690          ADD     HL,HL
F20D 29        03700          ADD     HL,HL
F20E 29        03710          ADD     HL,HL
F20F B4        03720          OR      H
F210 67        03730          LD      H,A
F211 1800      03740          JR      PATOUT
F213 E5        03750 PATOUT   PUSH    HL              ;SAVE ADDR ON STACK
F214 2ADEF1    03760          LD      HL,(TEMP)       ;GET STRING POINTER
F217 46        03770          LD      B,(HL)          ;STRING LENGTH
F218 23        03780          INC     HL              ;NEXT WORD IS POINTER TO STR
ING
F219 5E        03790          LD      E,(HL)          ;LOAD STRING POINTER
F21A 23        03800          INC     HL
F21B 56        03810          LD      D,(HL)
F21C E1        03820          POP     HL              ;GET VRAM ADDRESS
F21D CBF4      03830          SET     6,H             ;PREPARE TO WRITE TO VRAM
F21F CD9FF3    03840          CALL    OUTADR          ;SEND ADDRESS TO VRAM
F222 EB        03850          EX      DE,HL           ;HL POINTS TO STRING
F223 58        03860          LD      E,B             ;LOOP COUNTER
F224 CB3B      03870          SRL     E               ;DIVIDE BY 2
F226 CD2FF2    03880 LOOP3    CALL    CVERT           ;CONVERT ASCI TO HEX
F229 D301      03890          OUT     (1),A           ;LOAD TABLE
F22B 1D        03900          DEC     E
F22C 20F8      03910          JR      NZ,LOOP3        ;FINISHED?
F22E C9        03920          RET
               03930 ;CONVERT 2 BYTE ASCII TO 1 BYTE HEX
F22F 0E00      03940 CVERT    LD      C,0             ;CLEAR RESULT
F231 7E        03950          LD      A,(HL)          ;GET FIRST CHAR
F232 FE60      03960          CP      60H             ;CHECK FOR LOWER CASE
F234 FA39F2    03970          JP      M,UPCASE        ;GO IF UPPER CASE
F237 D620      03980          SUB     20H             ;COMVERT TO UPPER CASE
F239 CD4CF2    03990 UPCASE   CALL    CONVT           ;CONVERT CHAR TO HEX
F23C 4F        04000          LD      C,A             ;SAVE FIRST NIBBLE
F23D CB21      04010          SLA     C               ;ALIGN THE TWO NIBBLES
F23F CB21      04020          SLA     C
F241 CB21      04030          SLA     C
F243 CB21      04040          SLA     C
F245 23        04050          INC     HL              ;NEXT CHAR
F246 7E        04060          LD      A,(HL)          ;GET SECOND CHAR
F247 CD4CF2    04070          CALL    CONVT           ;CONVERT CHAR TO HEX
F24A 23        04080          INC     HL              ;INCREMENT CHAR
F24B C9        04090          RET
F24C D630      04100 CONVT    SUB     30H             ;CONVERT 0-15
F24E FE0A      04110          CP      10D             ;CHECK FOR A-F
F250 FA55F2    04120          JP      M,JUMP1         ;GO IF 0-9
F253 D607      04130          SUB     7               ;CONVERT A-F TO 10-15
F255 81        04140 JUMP1    ADD     A,C             ;MERGE RESULT
F256 C9        04150          RET
               04160 ;
               04170 ;*****************************************************
               04180 ;
               04190 ;USR5  DEFINE SPRITE PATTERN  SMALL 1-256 LARGE 1-64
               04200 ;PATTERN # PASSED IN USR5
               04210 ;POINTER TO STRING PASSED IN USR3 TEMP
               04220 ;
F257 CD7F0A    04230 USER5    CALL    0A7FH           ;LOAD SPRITE NUMBER
F25A 7C        04240          LD      A,H             ;TEST FOR ZERO SPRITE NUMBER

F25B B5        04250          OR      L
F25C CACAF0    04260          JP      Z,ERROR
F25F 2B        04270          DEC     HL              ;CORRECT OFF BY 1 SPRITE NUM
BER ERROR
F260 3A9FF1    04280          LD      A,(SPRTSZ)      ;LOAD SPRITE SIZE
F263 B7        04290          OR      A
F264 280C      04300          JR      Z,SPRT8
F266 3D        04310          DEC     A
F267 2819      04320          JR      Z,SPRT16
F269 3D        04330          DEC     A
F26A 2806      04340          JR      Z,SPRT8
F26C 3D        04350          DEC     A
F26D 2813      04360          JR      Z,SPRT16
F26F C3CAF0    04370          JP      ERROR
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	NAME	DESCRIPTION
1	RULE78	Interest Apportionment by Rule of the 78's
2	ANNUI	Annuity computation program
3	DATE	Time between dates
4	DAYYEAR	Day of year a particular date falls on
5	LEASEINT	Interest rate on lease
6	BREAKEVN	Breakeven analysis
7	DEPRSL	Straightline depreciation
8	DEPRSY	Sum of the digits depreciation
9	DEPRDB	Declining balance depreciation
10	DEPRDDB	Double declining balance depreciation
11	TAXDEP	Cash flow vs. depreciation tables
12	CHECK2	Prints NEBS checks along with daily register
13	CHECKBK1	Checkbook maintenance program
14	MORTGAGE/A	Mortgage amortization table
15	MULTMON	Computes time needed for money to double, triple, etc.
16	SALVAGE	Determines salvage value of an investment
17	RRVARIN	Rate of return on investment with variable inflows
18	RRCONST	Rate of return on investment with constant inflows
19	EFFECT	Effective interest rate of a loan
20	FVAL	Future value of an investment (compound interest)
21	PVAL	Present value of a future amount
22	LOANPAY	Amount of payment on a loan
23	REGWITH	Equal withdrawals from investment to leave 0 over
24	SIMPDISK	Simple discount analysis
25	DATEVAL	Equivalent & nonequivalent dated values for oblig.
26	ANNUDEF	Present value of deferred annuities
27	MARKUP	% Markup analysis for items
28	SINKFUND	Sinking fund amortization program
29	BONDVAL	Value of a bond
30	DEPLETE	Depletion analysis
31	BLACKSH	Black Scholes options analysis
32	STOCVAL1	Expected return on stock via discounts dividends
33	WARVAL	Value of a warrant
34	BONDVAL2	Value of a bond
35	EPSEST	Estimate of future earnings per share for company
36	BETAALPH	Computes alpha and beta variables for stock
37	SHARPE1	Portfolio selection model-i.e. what stocks to hold
38	OPTWRITE	Option writing computations
39	RTVAL	Value of a right
40	EXPVAL	Expected value analysis
41	BAYES	Bayesian decisions
42	VALPRINF	Value of perfect information
43	VALADINF	Value of additional information
44	UTILITY	Derives utility function
45	SIMPLEX	Linear programming solution by simplex method
46	TRANS	Transportation method for linear programming
47	EOQ	Economic order quantity inventory model
48	QUEUE1	Single server queueing (waiting line) model
49	CVP	Cost-volume-profit analysis
50	CONDPROF	Conditional profit tables
51	OPTLOSS	Opportunity loss tables
52	FQUOQ	Fixed quantity economic order quantity model
53	FQEOWSH	As above but with shortages permitted
54	FQEOQPB	As above but with quantity price breaks
55	QUEUECB	Cost-benefit waiting line analysis
56	NCFANAL	Net cash-flow analysis for simple investment
57	PROFIND	Profitability index of a project
58	CAPI	Cap. Asset Pr. Model analysis of project
59	WACC	Weighted average cost of capital
60	COMPBAL	True rate on loan with compensating bal. required
61	DISCBAL	True rate on discounted loan
62	MERGANAL	Merger analysis computations
63	FINRAT	Financial ratios for a firm
64	NPV	Net present value of project
65	PRINDLAS	Laspeyres price index
66	PRINDPA	Paasche price index
67	SEASIND	Constructs seasonal quantity indices for company
68	TIMETR	Time series analysis linear trend
69	TIMEMOV	Time series analysis moving average trend
70	FUPRINF	Future price estimation with inflation
71	MAILPAC	Mailing list system
72	LETWRT	Letter writing system-links with MAILPAC
73	SORT3	Sorts list of names
74	LABEL1	Shipping label maker
75	LABEL2	Name label maker
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78	ACCTPAY	In memory accounts payable system-storage permitted
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80	INVENT2	In memory inventory control system
81	TELDIR	Computerized telephone directory
82	TIMUSAN	Time use analysis
83	ASSIGN	Use of assignment algorithm for optimal job assign.
84	ACCTREC	In memory accounts receivable system-storage ok
85	TERMSPAY	Compares 3 methods of repayment of loans
86	PAYNET	Computes gross pay required for given net
87	SELLPR	Computes selling price for given after tax amount
88	ARBCOMP	Arbitrage computations
89	DEPRSF	Sinking fund depreciation
90	UPSZONE	Finds UPS zones from zip code
91	ENVELOPE	Types envelope including return address
92	AUTOEXP	Automobile expense analysis
93	INSFILE	Insurance policy file
94	PAYROLL2	In memory payroll system
95	DILANAL	Dilution analysis
96	LOANAFFD	Loan amount a borrower can afford
97	RENTPRCH	Purchase price for rental property
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                04380 ;FIND ADDRESS OF 0X8 SPRITE IN TABLE
F272 3E03       04390 SPRT8   LD      A,SGBA          ;LOAD SPRITE PATTERN GEN BAS
E ADR
F274 CB27       04400         SLA     A
F276 CB27       04410         SLA     A
F278 CB27       04420         SLA     A
F27A 29         04430         ADD     HL,HL
F27B 29         04440         ADD     HL,HL
F27C 29         04450         ADD     HL,HL
F27D B4         04460         OR      H
F27E 67         04470         LD      H,A
F27F C313F2     04480         JP      PATOUT          ;CONVERT AND LOAD PATTERN
                04490 ;FIND ADDRESS OF 16X16 SPRITE IN TABLE
F282 7D         04500 SPRT16  LD      A,L             ;LOAD SPRITE NUMBER
F283 E63F       04510         AND     3FH             ;LIMIT TO 63
F285 6F         04520         LD      L,A             ;SAVE SPRITE NUMBER
F286 29         04530         ADD     HL,HL           ;SHIFT OVER
F287 29         04540         ADD     HL,HL           ;SHIFT OVER ONCE MORE
F288 C372F2     04550         JP      SPRT0           ;FINISH UP IS THE SAME
                04560
                04570 ;
                04580 ;*****************************************************
                04590 ;
                04600 ;USR6 SET COLORS FOR VARIOUS MODES
                04610 ;PASS PATTERN # IN USR6 CALL
                04620 ;PASS VARPTR TO STRING IN USR3 CALL  TEMP
                04630 ;
F28B CD7F0A     04640 USER6   CALL    0A7FH           ;LOAD HL REGISTER
F28E 3AFDF0     04650         LD      A,(MODE)        ;GET MODE VALUE
F291 B7         04660         OR      A
F292 280C       04670         JR      Z,CTEXT         ;SET TEXT COLORS
F294 3D         04680         DEC     A
F295 2818       04690         JR      Z,CMULTI        ;SET MULTI COLORS
F297 3D         04700         DEC     A
F298 2824       04710         JR      Z,CGRP1         ;SET GRP1 COLORS
F29A 3D         04720         DEC     A
F29B 2836       04730         JR      Z,CGRP2         ;SET GRP2 COLORS
F29D C3CAF0     04740         JP      ERROR
                04750 ;SET TEXT COLORS
F2A0 23         04760 CTEXT   INC     HL
F2A1 5E         04770         LD      E,(HL)          ;LOAD POINTER TO STRING
F2A2 23         04780         INC     HL
F2A3 56         04790         LD      D,(HL)
F2A4 EB         04800         EX      DE,HL
F2A5 CD2FF2     04810         CALL    CVERT           ;CONVERT ASCII TO HEX
F2A8 3205F1     04820         LD      (REG7),A
F2AB CDEEF0     04830         CALL    REGLD
F2AE C9         04840         RET
                04850 ;SET MULTICOLOR MODE PATTERN COLORS
F2AF 7D         04860 CMULTI  LD      A,L             ;SAVE NAME
F2B0 2600       04870         LD      H,PGBA          ;LOAD PATTERN GEN BASE ADDR
F2B2 CB3C       04880         SRL     H
F2B4 CB1D       04890         RR      L
F2B6 B5         04900         OR      L
F2B7 6F         04910         LD      L,A
F2B8 29         04920         ADD     HL,HL
F2B9 29         04930         ADD     HL,HL
F2BA 29         04940         ADD     HL,HL
F2BB C313F2     04950         JP      PATOUT
                04960 ;SET COLOR PATTERN FOR GRAPHICS 1 MODE
F2BE 7D         04970 CGRP1   LD      A,L
F2BF CB3F       04980         SRL     A
F2C1 CB3F       04990         SRL     A
F2C3 CB3F       05000         SRL     A
F2C5 21FF00     05010         LD      HL,CTBA         ;LOAD COLOR TABLE BASE ADDR
F2C8 29         05020         ADD     HL,HL
F2C9 29         05030         ADD     HL,HL
F2CA 29         05040         ADD     HL,HL
F2CB 29         05050         ADD     HL,HL
F2CC 29         05060         ADD     HL,HL
F2CD 29         05070         ADD     HL,HL
F2CE B5         05080         OR      L
F2CF 6F         05090         LD      L,A
F2D0 C313F2     05100         JP      PATOUT
                05110 ;SET COLOR PATTERN FOR GRAPHICS 2 MODE
F2D3 3EFF       05120 CGRP2   LD      A,CTBA          ;LOAD COLOR TABLE BASE ADDR
F2D5 CB3F       05130         SRL     A
F2D7 CB3F       05140         SRL     A
F2D9 E620       05150         AND     20H
F2DB 29         05160         ADD     HL,HL
F2DC 29         05170         ADD     HL,HL
F2DD 29         05180         ADD     HL,HL
F2DE B4         05190         OR      H
F2DF 67         05200         LD      H,A
F2E0 C313F2     05210         JP      PATOUT
                05220 ;
                05230 ;*****************************************************
                05240 ;
                05250 ;USR7 SET SPRITE COLOR / NAME
                05260 ;PASS SPRITE NUMBER IN USR7  + = COLOR    - = NAME
                05270 ;PASS VARPTR IN TEMP POINTING TO STRING DEFINING COLOR
                05280 ;PASS VARPTR IN TEMP OF SPRITE NAME (PATTERN #)
                05290 ;
F2E3 CD7F0A     05300 USER7   CALL    0A7FH           ;LOAD VALUE INTO HL
F2E6 7C         05310         LD      A,H             ;TEST FOR ZERO SPRITE NUMBER

F2E7 B5         05320         OR      L
F2E8 CACAF0     05330         JP      Z,ERROR
F2EB 7D         05340         LD      A,L
F2EC CB74       05350         BIT     6,H             ;NEGATIVE?
F2EE 2022       05360         JR      NZ,SPRNAM       ;JUMP IF NEGATIVE
F2F0 3D         05370         DEC     A               ;CORRECT OFF BY 1 ERROR IN S
PRITE #
F2F1 CDC9F1     05380         CALL    SPRLOC          ;FIND LOCATION OF SPRITE ATT
RIBUTE
F2F4 23         05390         INC     HL
F2F5 23         05400         INC     HL
F2F6 23         05410         INC     HL
F2F7 E5         05420         PUSH    HL
F2F8 2ADEF1     05430         LD      HL,(TEMP)       ;CONVERT CHAR TO HEX
F2FB 23         05440         INC     HL
F2FC 5E         05450         LD      E,(HL)          ;LOAD CHAR POINTER
F2FD 23         05460         INC     HL
F2FE 56         05470         LD      D,(HL)
F2FF EB         05480         EX      DE,HL
F300 7E         05490         LD      A,(HL)          ;GET CHAR
F301 D630       05500         SUB     30H             ;ASCII - HEX
F303 FE0A       05510         CP      10D             ;CHECK FOR A-F
F305 FA0AF3     05520         JP      M,JUMP2         ;GO IF 0-9
F308 D607       05530         SUB     7               ;CONVERT A-F
F30A E60F       05540 JUMP2   AND     0FH             ;MASK OFF HIGH BYTES
F30C E1         05550         POP     HL              ;GET SPRITE COLOR ADDR
F30D 5F         05560         LD      E,A             ;STORE COLOR
F30E CDAEF3     05570         CALL    WRTRAM          ;LOAD INTO VRAM
F311 C9         05580         RET
F312 2F         05590 SPRNAM  CPL                     ;CONVERT NEGATIVE NUMBER
F313 CDC9F1     05600         CALL    SPRLOC          ;FIND LOCATION OF SPRITE ATT
RIBUTE
F316 110200     05610         LD      DE,02           ;RELATIVE BYTE OF SPRITE NAM
E
F319 19         05620         ADD     HL,DE           ;ADD INCREMENT
F31A 3ADEF1     05630         LD      A,(TEMP)        ;LOAD SPRITE NAME
F31D 3D         05640         DEC     A               ;CORRECT FOR OFF BY ONE ON S
PRITE PLANES
F31E F5         05650         PUSH    AF              ; SAVE ON STACK
F31P 3A9FF1     05660         LD      A,(SPRTSZ)      ;LOAD SPRITE SIZE
F322 FE00       05670         CP      0               ;IS IT AN 8X8*1
F324 CA30F3     05680         JP      Z,NSHFT         ;IP 8X8 WE DON'T HAVE TO SHI
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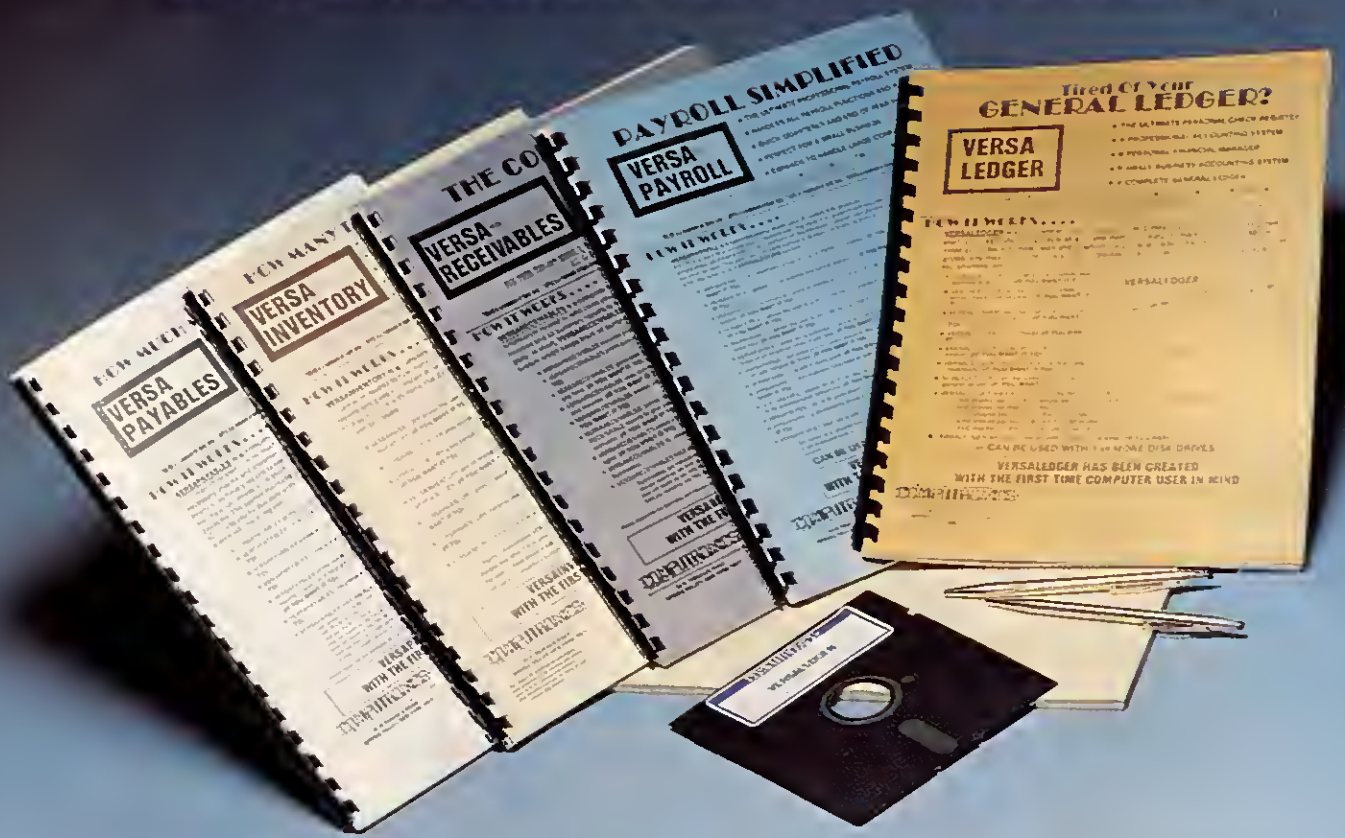

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Listing 2 continued

```
FT
F327 FE02     05690          CP      2               ;IS IT AN 8X8*2 SPRITE
F329 CA30F3   05700          JP      Z,NSHFT         ;IF 8X8 WE DON'T HAVE TO SHI
FT
F32C F1       05710          POP     AF              ;GET SPRITE NAME FROM STACK
F32D 87       05720          ADD     A,A
F32E 87       05730          ADD     A,A             ;SHIFT TWICE
F32F F5       05740          PUSH    AF              ;SAVE ON STACK
F330 F1       05750 NSHFT    POP     AF              ;GET VALUE FROM STACK
F331 5F       05760          LD      E,A             ;SET UP NAME POINTER
F332 CDAEF3   05770          CALL    WRTRAM          ;SEND NAME TO VRAM
F335 C9       05780          RET
              05790 ;
              05800 ;*****************************************************
              05810 ;
              05820 ;USR8  CLEAR SCREEN / CLEAR SPRITES
              05830 ;FILL THE SCREEN WITH PATTERN ZERO / TURN OFF SPRITE PROCESS
ING
              05840 ;1 = CLEAR SCREEN        -1 = CLEAR SPRITES
              05850 ;
F336 CD7F0A   05860 USR8     CALL    0A7FH           ;LOAD VALUE PASSED FROM BASI
C
F339 CB7C     05870          BIT     7,H             ;MINUS?
F33B 280F     05880          JR      Z,CLS           ;JUMP TO CLS IF +
F33D 0620     05890 CLRSPR   LD      B,32            ;LOOP COUNTER
F33F 1ED0     05900          LD      E,208D          ;SPRITE OFF INDICATOR IN VER
TICAL
F341 78       05910 LOOP4    LD      A,B
F342 3D       05920          DEC     A               ;FORM SPRITE NUMBER
F343 CDC9F1   05930          CALL    SPRLOC          ;FIND SPRITE ATTRIBUTE LOCAT
ION
F346 CDAEF3   05940          CALL    WRTRAM          ;WRITE VALUE TO VRAM
F349 10F6     05950          DJNZ    LOOP4
F34B C9       05960          RET
F34C 260F     05970 CLS      LD      H,NTBA          ;LOAD NAME TABLE BASE ADDRES
S
F34E CB24     05980          SLA     H
F350 CB24     05990          SLA     H
F352 2E00     06000          LD      L,0
F354 1E00     06010          LD      E,0
F356 01C003   06020          LD      BC,960D         ;MAX NUMBER OF CHAR
F359 CDAEF3   06030          CALL    WRTRAM
F35C 3E00     06040 CLR      LD      A,0
F35E D301     06050          OUT     (1),A
F360 0B       06060          DEC     BC
F361 78       06070          LD      A,B
F362 B1       06080          OR      C
F363 C25CF3   06090          JP      NZ,CLR
F366 210000   06100          LD      HL,0            ;RESET CURSOR POINTER
F369 22DEF1   06110          LD      (TEMP),HL
F36C C9       06120          RET
              06130 ;
              06140 ;*****************************************************
              06150 ;
              06160 ;USR9 PRINT CHAR AT TEMP LOCATION
              06170 ;PASS PATTERN NUMBER IN USR9
              06180 ;TEMP HAS THE SCREEN LOCATION AND IS INCREMENTED
              06190 ;
F36D CD7F0A   06200 USR9     CALL    0A7FH           ;LOAD NAME OF PATTERN
F370 5D       06210          LD      E,L             ;MOVE NAME
F371 2ADEF1   06220          LD      HL,(TEMP)       ;LOAD PATTERN POSITION
F374 3E0F     06230          LD      A,NTBA          ;LOAD NAME TABLE BASE ADDRES
S
F376 CB27     06240          SLA     A
F378 CB27     06250          SLA     A
F37A B4       06260          OR      H
F37B 67       06270          LD      H,A
F37C CDAEF3   06280          CALL    WRTRAM          ;LOAD PATTERN NAME INTO VRAM

F37F 2ADEF1   06290          LD      HL,(TEMP)
F382 23       06300          INC     HL
F383 E5       06310          PUSH    HL
F384 3AFDF0   06320          LD      A,(MODE)        ;GET MODE OF OPERATION
F387 B7       06330          OR      A               ; SET FLAGS
F388 2005     06340          JR      NZ,NTEXT        ;JUMP IF NOT TEXT MODE
F38A 1140FC   06350          LD      DE,-960         ;NUMBER OF TEXT CHAR
F38D 1803     06360          JR      WRAP            ;WRAP AROUND FROM END OF SCR
EEN
F38F 1100FD   06370 NTEXT    LD      DE,-768D        ;NONTEXT PATTERNS
F392 19       06380 WRAP     ADD     HL,DE
F393 7C       06390          LD      A,H
F394 B5       06400          OR      L
F395 E1       06410          POP     HL
F396 2003     06420          JR      NZ,NZERO
F398 210000   06430          LD      HL,0
F39B 22DEF1   06440 NZERO    LD      (TEMP),HL
F39E C9       06450          RET
              06460 ;
              06470 ;*****************************************************
              06480 ;
              06490 ;OUTPUT ADR FOR VDP MEM READ OR WRITE
              06500 ;BC = ADDRESS
F39F 7D       06510 OUTADR   LD      A,L             ;LOAD LOW BYTE OF ADDRESS
F3A0 D302     06520          OUT     (2),A           ;SEND TO VDP
F3A2 7C       06530          LD      A,H             ;LOAD HIGH BYTE OF ADDRESS
F3A3 D302     06540          OUT     (2),A           ;SEND TO VDP
F3A5 C9       06550          RET
              06560 ;
              06570 ;WRITE VALUE TO VDP REGISTER
              06580 ;
              06590 ; C= REG#   A = VALUE
F3A6 D302     06600 WRTREG   OUT     (2),A           ;SEND TO VDP THE VALUE
F3A8 79       06610          LD      A,C             ;GET THE REGISTER NUMBER
F3A9 F680     06620          OR      128D
F3AB D302     06630          OUT     (2),A           ;SEND TO VDP THE REGISTER #
F3AD C9       06640          RET
              06650 ;
              06660 ;WRITE TO VRAM
              06670 ;HL= ADDRESS     E = VALUE
F3AE 7C       06680 WRTRAM   LD      A,H
F3AF F640     06690          OR      64D
F3B1 67       06700          LD      H,A
F3B2 CD9FF3   06710          CALL    OUTADR
F3B5 7B       06720          LD      A,E
F3B6 D301     06730          OUT     (1),A
F3B8 C9       06740          RET
              06750 ;
              06760 ;READ VDP STATUS REG
              06770 ;RETURN VALUE IN A REG
F3B9 DB02     06780 RDREG    IN      A,(2)
F3BB C9       06790          RET
              06800 ;
              06810 ;READ VDP RAM
              06820 ;HL = ADDRESS    RETURN VALUE IN A REGISTER
              06830 ;
F3BC CD9FF3   06840 RDRAM    CALL    OUTADR
F3BF 3AC8F3   06850          LD      A,(MICRO8)
F3C2 CDC9F3   06860          CALL    DELAY
F3C5 DB01     06870          IN      A,(1)
F3C7 C9       06880          RET
F3C8 01       06890 MICRO8   DEFB    1D      ;DELAY VALUE
              06900 ;
              06910 ;DELAY LOOP, 8 MICRO SEC FOR TRS-80 X2
              06920 ;
F3C9 47       06930 DELAY    LD      B,A
F3CA E5       06940          PUSH    HL
F3CB E1       06950          POP     HL
F3CC 10FC     06960          DJNZ    DELAY+1
F3CE C9       06970          RET
              06980 ;*****************************************************
F000          06990          END     USR0
00000 TOTAL ERRORS
```

The Complete Book Of Random Access Data File Programming

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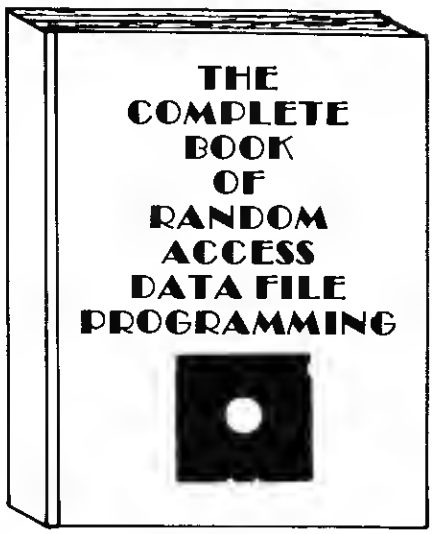

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Buyer's Guide to Utilities

Utilities are a programmer's best friend. They can recover blown disks, make coding your program simpler, build versatility into a program, let you review and alter disk and tape files, and even let you improve your program's appearance.

Many different types of utilities exist and each type has its own options. This buyer's guide will help you determine which utilities you need and suggests some options you might find handy.

Assemblers

An assembler is an indispensible utility for the machine-code programmer. Programs written in machine code have to incorporate operation codes (op-codes), commands written in machine language. In a machine-language program listing, these commands are represented by a number.

For instance, to load the stack pointer register with the number 7000 hex,

Assemblers

Company Name	Product Name	Price	For Model(s)	Minimum RAM	Cassette or Disk	DOS(es) Supported	Separate Documentation	Back-up Possible
Computer Applications	T-ZAL	$49.95	III	16K	C	All	Y	Y
Z500 A-D Software	Zilog Z-80 Reloading MACASM	$49.95	II	64K	D	CP/M	Y	Y
Program Innovations	Macro Assembler	$74.95	II	64K	D	T	Y	Y

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Instant Software	DLDIS	$24.95	I	32K	D	DP, T	Y	Y
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MISOSYS	DSMBLR II	$20.00	I/III	16K	D	L, T	Y	Y
MISOSYS	DSMBLR III	$40.00	I/III	48K	D	L5.1, L6.0	Y	Y
PRO/AM Software	DISnDATa	$24.95 $29.95	I/III III	16K	C D	T	Y	Y

C = Cassette
D = Disk
CP/M = Control Program for Microprocessors
DP = DOSPLUS
L = LDOS
N = NEWDOS
T = TRSDOS
Y = Yes

your program would stipulate the Z80 hexadecimal opcode for this procedure, 31. But you also have to indicate the address location with the opcode, here 7000 hex. The Z80 microprocessor requires that addresses be back-to-front. So, the machine code would appear in the program like this: 31 00 70. For a single command, this is a fairly simple procedure. But when you write a program with hundreds of commands, imagine the chance for error. A misplaced number here, an inadvertent deletion there—it could turn into a tortuous experience.

This is where an assembler comes in handy. Assemblers let you specify a mnemonic command followed by the address. For example, LD SP,7000H loads the stack pointer with 7000 hex. The assembler takes this code (known as the source program) and assembles it into the appropriate machine code (the object program), now ready for the microprocessor. The object code is stored either in dynamic memory or on disk.

Assemblers perform other important functions. For one thing, they keep track of jumps in machine code. Say you hand-assembled a program with a command to jump to an opcode 10 bytes ahead. If you insert any code between the jump instruction and the jump destination, the microprocessor must take into account the inserted bytes to produce the appropriate jump. The assembler does this with labels. Signal the assembler that you want to jump to a specific, labeled opcode and the assembler inserts the correct number of bytes to do so.

Some assemblers, called conditional assemblers, let you skip over part of your source code under certain conditions. This is also done with labels, labels that stop the assembler's translation of the source code to object code for specified program lines.

To do this, set a label to a value somewhere in your source code. Then have the assembler test that label and either produce machine code from the source code or ignore the source code. This feature lets you produce two or more versions of the same machine-code program without having to write more than one source code.

Another type of assembler, called a macro assembler, lets you use macro instructions, sets of machine-code instructions defined within the body of the source program. Assign a name to a given set of frequently used instructions. Every time you want to use those instructions, call them by their assigned name. Coupled with conditional assembly, macro assembly gives your program powerful versatility.

Disassemblers

As their name suggests, disassemblers do the opposite of assemblers. Where an assembler turns mnemonic opcodes into hexadecimal object code, a disassembler translates the object code into mnemonic text. The resultant text can even contain labels automatically generated by the disassembler so that you can reassemble at any time.

A disassembler makes machine code easier to follow and understand. You can also disassemble a machine-code routine and alter it according to your needs. For instance, you may want to upgrade a program from tape to disk operation. With a disassembler, you could go into the program and change all the I/O routines from tape to disk.

Disk Zappers

These are a requirement for disk users. Disk zappers make most blown disks usable (though some disks may be destroyed beyond repair). In instances where a disk file is intact but cannot be accessed for some reason, a disk zapper recovers the disk.

Blown disks result from a number of causes. Dust, smoke particles, hair and other foreign matter can collect on the disk and prevent a blemish-free write. Unless you have automatic write-verification, you won't know there's a problem until you try to read the disk. A disk zap finds the bad sector and allows you to write over it with dummy information so the program loads. Although the program then has some garbage in it, it is easier to replace the garbage than have to rewrite the entire program.

Another common disk problem is power surges that occur during write operations, erasing part of a disk track. Since the sector no longer exists, it can't be repaired. You could use the disk by reformatting it, but that would mean

Warranty Information	Supports Macros	Conditional Assembly	Machine-Language Monitor	Object Code to RAM	Description
R	N	N	N	Y	Creates relocatable system tapes.
NA	Y	Y	N	Y	Includes Intel 8080 to Zilog Z80 source code converter and linker.
R	Y	Y	N	Y	Requires EDTASM.

Warranty Information	Relocatable	Labels	Output to Cassette, Disk, Printer or Screen	R/S Source Code Output	Description
R	Y	N	C, P, S	Y	
R	Y	Y	C, P, S	Y	Triple pass.
R	Y	Y	C, P, S	Y	Triple pass.
R	N	Y	C, D, P, S	N	Compatible with EDAS, M-80, Apparat, EDTASM+, MZAL, but not Series I.
R	N	Y	D, P, S	N	EDAS+ compatible; disassembles directly from disk.
NA	Y	Y	C, D, P, S	Y	Supports Radio Shack Series I and Apparat formats.

N = No
R = Replace Defective Media
M = Money-back guarantee
NA = Not available

erasing every track and sector on the disk. Fortunately, utilities exist that reformat the disk without affecting recoverable data.

Perhaps the most common problem is accidentally killing files. This happens so frequently that some disk zappers do nothing but find the dead file directory entry and restore it. This is done by altering a single bit on the disk utility and then restoring its entry in the directory hash index table (HIT). On many operating systems, the file itself remains intact after being killed, with only the directory entry being amended. Some disk zapper utilities provide the option of completely restoring old files.

Editors

Text editors are used to enter and manipulate text files from the keyboard. They are basically stripped-down word processors. The best reason to use a text editor is that many com-

Disk Zappers

Company Name	Product Name	Price	For Model(s)	Minimum RAM	Cassette or Disk	DOS(es) Supported	Separate Documentation	Back-up Possible
Instant Software	Disk Editor	$ 39.95	I	32K	D	D,T	Y	Y
PowerSoft	The Master Mechanic Set	$ 39.95	I/III/MAX-80	32K	D	L	Y	Y
PowerSoft	The Toolbox	$ 69.95	I/III/MAX-80	32K	D	L	Y	Y
RACET Computes	Superzap for CP/M	$100.00	II/12/16	32K	D	CP/M 2.2+	Y	Y
RACET Computes	Superzap 4.X	$100.00	II/12/16	64K	D	T	Y	Y
RACET Computes	Utility Package	$150.00	II/12/16	64K	D	T2.0	Y	Y

Editors

Company Name	Product Name	Price	For Model(s)	Minimum RAM	Cassette or Disk
Alternate Source	KBE	$ 39.95	I/III	32K	D
Alternate Source	EDM	$149.00	I/III	48K	D
Computer Applications	XBE	$ 29.95 $ 34.95	I/III	16K	C D

Editor/Assemblers

Company Name	Product Name	Price	For Model(s)	Minimum RAM	Cassette or Disk	DOS(es) Supported
Computer Applications	M-ZAL	$149.00	I/III	32K	D	All
Instant Software	Assem/ZSIM	$119.97	I	32K	D	DP, N, N80, T
MISOSYS	EDAS-IV	$100.00	I/III/IV	48K	D	L5.1, L6.0
Mumford Micro Systems	Instant Assembler	$ 39.95 $ 49.95	I/III	16K	C D	All
RACET Computes	Extended Development Package	$125.00	II/12/16	64K	D	T2.0

C = Cassette
D = Disk
CP/M = Control Program for Microprocessors
DP = DOSPLUS
L = LDOS
N = NEWDOS
T = TRSDOS
Y = Yes

puter languages process their source input (the program to be compiled or assembled) from a file which has to be typed in initially. Text editors are an integral part of many language-development systems and the primary method of preparing input files. Like a word processor, a good editor moves, changes, deletes, substitutes text and so on, and then saves it to a file for subsequent input to another program.

Screen editors are utilities offering distinct advantages over the line-editing process known to TRS-80 users. They allow cursor movement across the video screen without destroying any of the

Warranty Information	Modify by Track	Modify by File	Modify by Sector	Description
R	Y	Y	Y	Prints display, string search. ASCII or hex display.
R	Y	Y	Y	The best of the Toolbox (see below). Contains 10 machine-language programs.
R	Y	Y	Y	Contains many Super Utility Plus utilities, but Toolbox is unprotected and compatible with any floppy or hard drive.
M	Y	Y	Y	
M	Y	Y	Y	
M	Y	N	Y	Recovers blown disks.

DOS(es) Supported	Separate Documentation	Back-up Possible	Warranty Information	Full Cursor Control	Block Functions	Global Commands	Macro Keys	Search and Replace
All	Y	Y	M	Y	N	N	Y	N
All	Y	Y	M	Y	Y	Y	Y	Y
All	Y	Y	R	Y	Y	Y	Y	Y

Separate Documentation	Back-up Possible	Warranty Information	Supports Macros	Conditional Assembly	Renumberer	Search and Replace	Load R/S Source Code	Set Breakpoints
Y	Y	R	Y	Y	Y	Y	Y	N
Y	Y	R	N	Y	Y	Y	Y	Y
Y	Y	R	Y	Y	Y	Y	Y	N
Y	Y	M, R	N	N	N	N	Y	Y
Y	Y	M	Y	Y	Y	Y	Y	Y

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text the cursor passes over. Characters may be inserted, deleted or otherwise moved, and the altered line may be entered as if it were typed at an input prompt. Thus if you type a Print command with a misspelled file name, you would move the cursor to the error, correct the typo using the screen editor, and hit the enter key—much simpler than retyping the whole line and risking a new error. Screen editors can also provide options like direct entry of graphics characters or other characters not normally available from the keyboard.

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Monitors

Monitors can be simple or sophisticated. They provide an interface between a machine-code program and the programmer. Unlike a Basic program (or any other interpreted language), a machine-code program executes directly on the microprocessor chip. Some method has to be found to prevent a program still in the evolution stages from crashing the system without leaving a trace as to why. This is where the monitor program is a lifesaver.

"Monitors interface the machine-code program and the programmer."

Probably the most important function of a monitor is allowing the insertion of breakpoints within the code. Whenever such a breakpoint is encountered, the monitor regains control from the program being debugged. At this point you can check the status of registers in the microprocessor or bytes in RAM to ascertain whether your program is functioning as it should. The monitor allows subsequent resumption of the target program, ensuring that all registers are in the state they held at the time of the breakpoint.

All monitors permit displays or printouts in various formats, including hexadecimal, octal, decimal, ASCII, or symbolic (where symbols are displayed instead of values). These symbols are the mnemonics referred to in disassemblers. Some monitors offer a disassembler as an option. The data displayed or printed can be altered from the monitor and might affect the results of any resumed execution of the main program.

Another monitor option is single-stepped code, which allows execution of one opcode at a time. On many computers this is a hardware option, but it is not available on micros due to chip architecture.

Sorts are an invaluable feature of monitor utilities that save you from rewriting your own sort routine every time you need to rearrange data in a program. Many different sorting methods exist, each with their own selling point. Trade-offs are usually involved; one method may be quicker but take more space, another may use a small amount of RAM but take longer to sort.

Sorts operate on data already in RAM or on a disk file. Generally, if a file fits into memory, it's quicker to sort it there, losing no time transferring data back and forth between disks. If a file is too large for memory, a disk sort has to be performed, an occasion when a well-written, efficient sort routine is required to minimize the input/output overhead.

Depending on program design, a

good sort utility allows you to specify how your records are broken into fields. Once this is done, you designate by which field you want to sort. This field is known as the key field and might be a city field within an address data base. Some sorts let you specify more than one key field, allowing sorting within sorting. A file containing the companies arranged by city would also arrange the companies alphabetically within those cities.

It's sometimes necessary to join two files and ascertain that the resultant file is in some kind of order. This calls for a special utility called sort-merge. There is a conspicuous absence of this type of utility for the TRS-80 user.

Monitors

Company Name	Product Name	Price	For Model(s)	Minimum RAM	Cassette or Disk	DOS(es) Supported	Separate Documentation	Back-up Possible
Computer Applications	XBug	$ 19.95	I/III	16K	C	All	Y	Y
Howe Software	Monitor #3	$ 39.95	I/III	16K	C	All	Y	Y
Howe Software	Monitor #4	$ 49.95	I/III	16K	D	All	Y	Y
Howe Software	Monitor #5	$ 59.95	I/III	16K	D	All	Y	Y
Instant Software	ZSIM	$ 29.95	I	16K	C	DP, N, T	Y	Y
Mumford Micro Systems	Demon	$ 29.95	I/III	16K	C, D	All	Y	Y

Tape Utilities

Company Name	Product Name	Price	For Model(s)	Minimum RAM		DOS(es) Supported	Separate Documentation	Back-up Possible
Kensoft	Leader Lapper	$10.95	I	16K	C	—	Y	Y
Modtec	Copy-Tape	$11.95	I/III	16K	C	—	Y	Y
Mumford Micro Systems	Clone	$16.95 $21.95	I/III	16K	C D	All	Y	Y
Mumford Micro Systems	RESQ2	$19.95	I/III	16K	C	—	Y	Y

Disk Utilities

Company Name	Product Name	Price	For Model(s)	Minimum RAM	Cassette or Disk	DOS(es) Supported
Power Soft	Super Utility Plus 3.0	$79.95	I/III	48K	D	All
Pro-80 Systems	Procopy	$50.00	II/12/16	64K	D	T
ProSoft	RPM	$24.95	I/III	32K	D	All
RACET Computes	FASTBACK	$75.00	II/12/16	64K	D	T
RACET Computes	2.0 Speed-Up Kit	$99.95	II/12/16	64K	D	T

C = Cassette
D = Disk
CP/M = Control Program for Microprocessors
DP = DOSPLUS
L = LDOS
N = NEWDOS
T = TRSDOS
Y = Yes

Tape and Disk Utilities

Tape and disk utilities fall into two types: those that copy tapes and disks from one tape or disk to another, and those that dump tapes and disks in readable format so the user may view their contents.

On many computers, tape and data files are structured in individual blocks that can be read in one at a time and output the same way. Although this is

Continues on p. 144

Warranty Information	Disassembler	RAM Editor	Single Step	Relocatable	Set Breakpoints in RAM	Set Breakpoints in ROM	Description
R	N	Y	Y	Y	Y	N	
R	Y	Y	N	Y	N	N	
R	Y	Y	N	Y	N	N	Includes disk zapper.
R	Y	Y	Y	Y	Y	N	Includes disk zapper.
R							
M, R	Y	Y	Y	Y	Y	Y	

Warranty Information	Description
R	Increases cassette I/O by up to 80% without requiring program or file changes.
R	Duplicates Basic, machine-language, and data tapes.
R, M	Duplicates tapes, changes baud rate of Model III tapes.
R, M	A tape zapper. Restores crashed tape programs, including system, data and Basic tapes.

Separate Documentation	Back-up Possible	Warranty Information	Description
Y	N	R	Back-up copy included. Disk zapper included.
Y	Y	R	Disk back-up copies.
Y	Y	R	Measures rotation speed and fluctuations of disk drives.
Y	Y	M	High-speed.
Y	Y	M	Eliminates diagnostics and date and time entry to speed boot-up.

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File Utilities

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Custom Software Services	Disk Status Utility	$ 50.00	II/12/16	32K	D	T2.0
Custom Software Services	Programmable Menu	$ 50.00	II/12/16	32K	D	T2.0
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Data Associates	Copyfile	$ 24.95	I/III	32K	C, D	T
Instant Software	Basic Programming Assistant	$ 19.95	I	16K	C	DP, N, T
Instant Softwere	Disk Scope	$ 24.95	I	32K	D	DP, N, T
Internetlonel Computer Products	Disk-Menu and Directory	$ 29.95	I/III	32K	D	All
MicroTech Exports	Reformatter TRSDOS-CP/M	$249.00	II/16	64K	D	T
MicroTech Exports	Reformatter CP/M-IBM	$249.00	II	32K	D	CP/M
MicroTech Exports	Reformatter TRSDOS-DEC	$249.00	II/16	64K	D	T
MISOSYS	PDS	$ 40.00	I/III/IV	48K	D	L5.1, L6.0
RACET Computes	BLINK	$ 30.00	I/II/III/12/16	32K	D	T
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RACET Computes	6SF	$ 30.00	I/II/III/12/16	16K	C, D	T
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RACET Computes	XREF	$ 50.00	II/12/16	64K	D	T2.0
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Vinzant & Assoc.	The Manipulator	$ 29.95	I/III	48K	D	L, T

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Company Name	Product Name	Price	For Model(s)	Minimum RAM	Cassette or Disk	DOS(es) Supported
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PROSOFT	Trashman	$39.95	I/III	32K	D	All
RACET Computes	Remodel and Proload	$35.00 $40.00	I/III	16K	C D	T

C = Cassette
D = Disk
CP/M = Control Program for Microprocessors

DP = DOSPLUS
L = LDOS
N = NEWDOS

Separate Documentation	Back-up Possible	Warranty Information	Description
Y	Y	R	Checks all drives; displays disk name, type, and free space.
Y	Y	M,R	Programmable menu system, chains to sub-menus.
Y	Y	R (C only)	Compares differences between two disk-based Basic programs.
Y	Y	R (C only)	Copies programs between disks, copies copy-protected programs on Model III disks.
Y	Y	R, C	Lists variables and GOTO, GOSUB, and IF . . . THEN commands. References by Basic keywords.
Y	Y	R, C	Computes file password, gives file locations, zaps disk by file.
Y	Y	S	Displays detailed description of each disk program, gives file specs.
Y	Y	R	Reads and writes CP/M single-density disks. Runs in 8-bit mode.
Y	Y	R	Lets CP/M users read and write IBM single-density disks on Model IIs with CP/M.
Y	Y	R	Lets TRSDOS users read and write DEC RT-11 disks on Model II/16s. Runs in 8-bit mode.
Y	Y	R	Provides partitioned data sets of executable programs, limited data member access.
Y	Y	M	Has Basic Linker program, retains all variables and files.
Y	Y	M	Keeps track of thousands of programs in a categorized library.
Y	Y	M	A multi-volume, multi-file disk sort merge.
Y	Y	M	High-speed machine-language sorts, memory moves, and data manipulation.
Y	Y	M	B-TREE ISAM utility. Handles up to 16.7 megabytes of data.
Y	Y	M	Basic cross references.
Y	Y	R	File copy utility.
Y	Y	R	Converts sequential files to random and vice versa, sort files, add/remove fields, change record length.

Separate Documentation	Back-up Possible	Warranty Information	Renumberer	Remove Blanks and Remarks	Produce Multi-Line Statements	Unpack	Duplicate Line Groups	Move Line Blocks
Y	Y	R	Y	Y	N	N	NA	NA
Y	Y	R	NA	Y	N	N	NA	NA
Y	Y	R	NA	NA	NA	NA		
Y	Y	R	NA	Y	N	N	NA	NA
Y	Y	R						
Y	Y	M	Y	NA	NA	NA	Y	Y

T = TRSDOS
Y = Yes
N = No

R = Replace Defective Media
M = Money-back guarantee
NA = Not available

General Utilities

Company Name	Product Name	Price	For Model(s)	Minimum RAM	Cassette or Disk	DOS(es) Supported	Separate Documentation	Back-up Possible
Absecon Software	Cobol Utility Program	$ 34.95	II/III	48K	D	T	Y	Y
Absecon Software	Cobol Utility Program II	$ 49.95	II/III	48K	D	T	Y	Y
Bulldog Software	ULTPLS	$ 10.95	I	16K	C	—	Y	NA
Data Associates	Pager	$ 24.95	I/III	32K	D	T	Y	Y
Data Associates	Rebackup	$ 24.95	III	32K	D	T	Y	Y
Data Associates	Toolset 1	$ 89.95	III	32K	D	T	Y	Y
Data Associates	Unlist	$ 24.95	I/III	32K	D	T	Y	Y
Allen Gelder Software	EDIT	$ 40.00	I/III	16K	C, D	All	Y	Y
HPB Vector Co.	Copy-Not 1.2	$325.00	I/III	48K	D	T	Y	N
Instant Software	Disk-Tape Exchanger	$ 24.95	I	32K	D	NA	Y	Y
Instant Software	TRS-80 Tests	$ 14.95	I	16K	C	NA	Y	Y
The Management	Locker	$ 24.95	II/12/16	64K	D	T2.0, T4.1, T4.2	Y	Y
MISOSYS	CON80Z	$ 40.00	I/III/MAX-80	48K	D	L5.1	Y	Y
MISOSYS	CONVCPM	$ 40.00	I/III/MAX-80	48K	D	L5.1	Y	Y
MISOSYS	SOLE	$ 25.00	I	48K	D	L5.0, L5.1	Y	Y
MISOSYS	ZSHELL	$ 40.00	I/III	48K	D	L5.1	Y	Y
Modular Software Assoc.	NEWBASIC 2.0	$ 39.95	I/III	48K	D	D, L, N, T	Y	Y
MTS Inc.	FORMAT/80	$ 18.95	I	32K	D	N, N80, T	Y	Y
PowerSoft	MAKE/80	$ 19.95	I/III	32K	D	NA	Y	N
RACET Computes	COMPROC	$ 30.00 $ 35.00	I/III	32K	C D	T	Y	Y
RACET Computes	Utility Package	$150.00	II	NA	D	NA	Y	Y
David Ray, CPA	Fortran 510	$120.00	II/12/16	64K	D	T2.0, T4.1	Y	Y
David Ray, CPA	Fortran Utilities	$ 70.00	II/12/16	64K	D	T2.0, T4.1	Y	Y
David Ray, CPA	RS Cobol Utilities	$120.00	II/12/16	64K	D	T2.0, T4.1	Y	Y
Softshell	MAP	$125.00	II/III	32K	D	NA	Y	Y
Softshell	MINIMAP	$ 25.00	II/III	32K	D	NA	Y	Y
Tremont Associates	PRTPRO	$ 35.00	II/12/16	64K	D	T	Y	Y
Vinzant & Assoc.	LDOS Help Command	$ 19.95	I/III	16K	D	L	Y	Y

C = Cassette
D = Disk
CP/M = Control Program for Microprocessors
DP = DOSPLUS
L = LDOS
N = NEWDOS
T = TRSDOS
Y = Yes

Warranty Information	Description
NA	Transfers Cobol source programs from the Model II to the Model III.
NA	Transfers Cobol source programs from the Model III to the Model II.
R	Basic editor with monitor.
R (C only)	Gives paged listings of Basic programs from disk.
R (C only)	Makes unlimited copies of Scripsit and VisiCalc.
R	A collection of utilities permitting paged listings, program packing, program comparisons, and copying protected programs.
R (C only)	Modifies Basic programs from disk to make listing difficult.
R	Basic editor; full cursor control, block functions, global command, search and replace.
R	Protects Basic programs from copying; cannot be unlocked with pirating software. One back-up free with registration.
R	Transfers machine-language tape programs to disk and vice versa.
R	Tests Level II ROMs and RAMs for bad bits; tests keyboard for dirty keys; tests data and address lines.
NA	Protects Basic programs from LIST and LLIST by unauthorized users.
R	Converts 8080 mnemonic assembler source files to Z80.
R	Transfers files from selected CP/M media to LDOS.
R	Lets you boot a double-density LDOS system disk.
R	Provides UNIX-like shell facilities for LDOS.
R	Enhances Disk Basic with selectable commands.
R	Single-track formatting program.
NA	Makes a 35-/40-track disk bootable in an 80-track drive.
M	Facilitates automatic command/data entry from a predefined process list file from a Basic disk.
M	Copies files, reads and modifies sectors, analyzes the Hash Index Table and Gran Allocation Table plus other features.
R	Fortran callable subroutines providing access to Model II/12/16 serial channels for I/O.
R	Provides Fortran direct-cursor addressing capability.
R	Utility subroutines callable from Cobol provide enhanced disk, printer, and screen capabilities.
R	Information storage and retrieval system for unstructured data.
R	Information storage and retrieval system for unstructured data.
M	Reduces development time for Cobol programs.
R	Adds Help command to LDOS-513.

N = No
R = Replace Defective Media
M = Money-back guarantee
NA = Not available

Continued from p. 141

true of data files in the Models I and III, it's not true of Basic or machine-code programs, and specialized utilities are required to copy system tapes and disks.

The block format found in other computers allows single blocks to be read and the tape stopped between each to allow that block to be copied to another tape. This isn't possible with the TRS-80 program tapes; information would be lost as there are no inter-block gaps. Basic data tapes are saved a block at a time, however. Disks can be copied in their entirety with one command, or one file at a time.

Some tape and disk utilities let you view the stored data so its layout can be seen encoded. This is especially useful when debugging a piece of software that outputs a tape or data file, since a bug can intervene and cause output to be different than anticipated. A few copy utilities also allow the tape data to be viewed; this allows you to change portions of the data before dumping a new version.

File Utilities

Some file utilities work like tape and disk utilities on a smaller scale, copying individual files between disks rather than the entire contents of a disk. Some read and write files between different formats, such as TRSDOS and IBM, and some merge several files (like chapters of a book) into one.

Others concern themselves with examining and manipulating the contents of a file. These usually give more detailed information—such as an expanded menu or catalog of the disk's contents—than the utilities provided with an operating system. Finally, some imitate the editing features of a DBMS, letting you sort, add, or remove fields.

Compressors/Renumberers

Compressors simply remove blanks from your program so that it compiles faster and therefore reduces processing time. Say you write a string array that uses only 56 of the 256 bytes available per Basic line. A compressor utility directs the processor over the 200 blanks and brings it to the next data line.

Renumberers should be the last utility you use in developing a program. Renumber utilities renumber the lines in a program. Instead of increments of 10 between lines, say, you might want increments of 20. Larger increments allow you to insert lines to enhance the program or install other features. A tested and neatly renumbered program listing is aesthetically pleasing. ■

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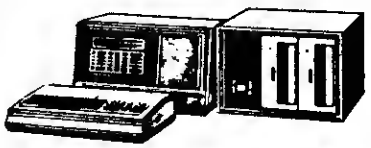

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DOSPLUS II

by Art Huston

Need a snazzy new operating system for your Model II, 12, or 16? DOSPLUS II and the Z80 give TRSDOS and CP/M a run for their money.

★ ★ ★ ★ ½

DOSPLUS II
Micro-Systems Software Inc.
4301-18 Oak Circle
Boca Raton, FL 33431
Powersoft Inc.
11500 Stemmons Freeway
Suite 125
Dallas, TX 74229
Model II, 12, 16
$249.95

DOSPLUS II is a Model II/12/16 operating system from Micro-Systems Software and Powersoft. It runs in the Z80 mode (not the 68000), but for these applications it sets a new standard in power and ease of use. TRSDOS and CP/M, move over.

The operating system is a joint collaboration of the Model I/III DOSPLUS programmers and Kim Watt (of Super Utility fame), so you know the bloodlines are good. Their stated goal was to create a powerful, easy-to-use, device-independent system with little or no sacrifice in speed. For the most part they have succeeded admirably. Along the way they added such goodies as hard disk support and an extra 4K of memory.

This review will give you an idea of how DOSPLUS II differs from TRSDOS; it does not document the entire operating system. If you don't see a TRSDOS feature mentioned, don't assume that DOSPLUS II doesn't have it. It also points out command differences between the two that may give you trouble.

Model I/III programmers take note: By the time you read this, DOSPLUS 3.5 will be on the market. The prerelease versions we've seen at *80 Micro* are very similar to DOSPLUS II.

Device #	Device	Default Name	Class
0	Keyboard	KI	Input
1	Display	DO	Output
2	Printer	PR	Output
3	Serial Port A	CA	Input or Output
4	Serial Port B	CB	Input or Output
5	User-defined	U1	User-defined
6	User-defined	U2	User-defined
7	User-defined	U3	User-defined
8	First Drive	0	Input or Output
9	Second Drive	1	Input or Output
10	Third Drive	2	Input or Output
11	Fourth Drive	3	Input or Output
12	Fifth Drive	4	Input or Output
13	Sixth Drive	5	Input or Output
14	Seventh Drive	6	Input or Output
15	Eighth Drive	7	Input or Output

Table 1. List of Device Specs

Getting Started

When I buy a complex operating system, I want to feel that no expense has been spared to document it. DOSPLUS II gives me this feeling. It comes in an attractive simulated-leather binder with five colored dividers for quick access to the major sections of the manual. The print is tack sharp. The manual leads you through the preliminary process of booting the disk and immediately making a backup.

The time and date commands are bypassed by pressing enter. I have some qualms with this, feeling that a business system should always maintain the date. What are nice, however, are the various ways in which you can enter these items. DOSPLUS II recognizes many different delimiters. You can correctly enter the date in the following ways and more: 6:27:83, 06:27:83, 06:27:1983, 6-27-83, 6 27 83 and 6.27.83. This versatility is evident in most of the commands.

The DEMO/TXT file runs the first time you boot the system. It leads you through the highlights of operation, while showing you examples of command syntax along the way.

The manual, however, states that at first boot-up you go into the DOS command mode. At this point Model 12 and 16 owners must type MOD16 to configure the drives. Failure to do so before the drive light goes out generates an error message and the disk is unreadable until the next reset. It is a simple process

RUN BASIC PROGRAMS AT SUPER SPEED WITH ZBASIC 2.2.

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4. *ZBASIC 2.2 is now a super tool for business programmers: RANDOM ACCESS FILES, and PRINT USING statements are supported as well as a HIGH PRECISION MATH package (with no rounding problems).*
5. *Special BUILT-IN MACHINE LANGUAGE COMMANDS to increase program operation by as much as 1000 times! Special commands are implemented for fast memory searching (CPDR, CPIR), block memory moves (LDIR, LDDR), inputting and printing HEX numbers, inserting MACHINE LANGUAGE into COMPILED CODE, disabling and enabling interrupts, inverting memory, 16 bit PEEKs and POKEs, and stack control, debug and much more.*
6. *ZBASIC 2.2 compiles the ENTIRE PROGRAM into Z-80 machine language. (Not 8080 code or a combination of BASIC and machine language like some other compilers.) Clumsy LINKING LOADERS, and RUNTIME MODULES are not needed; ZBASIC 2.2 creates a ready to run MACHINE LANGUAGE program.*
7. *NO ROYALTIES imposed on registered ZBASIC owners.*
8. *Typical COMPILATION TIME is TWO SECONDS for a 4K program.*
9. *Use TRS-80 Basic to write ZBASIC programs!*
10. *Compile some existing programs with only minor changes. (BASIC programming experience is required.)*
11. *Fully compatible with both the Model I and the Model III. Mod I compiled programs work on a MODEL III, and vice-versa. ZBASIC works with NEWDOS-80, NEWDOS+, DOSPLUS, LDOS, MULTIDOS, ULTRADOS, TRSDOS etc. (Not TRSDOS Mod I double density)*
12. *BUILT-IN and much improved MUSIC and SOUND EFFECTS commands.*
13. *Improved CHAINING for disk users.*
14. *TIME$ now available on DISK version. (Mod I only)*
15. *ZBASIC 2.2 now has an INPUT @ command (similar to PRINT @).*
16. *The TAB function will now tab 255 columns on a printer. (BASIC cannot tab past column 64.)*
17. *NEWDOS 80 2.0 USERS can use the CMD "dos command" function! (DOSPLUS may use name "dos command")*
18. *NEW and EASIER to use USR COMMANDS.*
19. *New math functions to calculate XOR and INTEGER REMAINDERS of a DIVISION*
20. *Logical STRING COMPARISONS are now supported.*
21. *The disk commands INSTR, MID$ ASSIGNMENT are now supported on both DISK AND TAPE ZBASIC.*
22. *DEFSTR is now supported.*
23. *Eight disk files may be opened simultaneously; random, sequential or mixed.*
24. *LINE INPUT#, is now supported.*
25. *Invoke the compiler by simply hitting these two keys: ":–"*
26. *NEW 60+ PAGE MANUAL WITH DESCRIPTIONS AND EXAMPLE.*
27. *ZBASIC 2.2 Comes with CMDFILE/CMD program from MISOSYS, to allow appending or merging compiled programs and machine language programs from tape or disk.*

ZBASIC 2.2 DOES NOT SUPPORT THESE BASIC COMMANDS:

1. ATN, EXP, COS, SIN, LOG, TAN, and exponentiation. (However, subroutines are included in the manual for these functions.)
2. ERROR, ON ERROR GOTO, ERL, ERR RESUME.
3. No direct commands like AUTO, EDIT, LIST, LLIST ETC. although these commands may be used when writing programs.
4. Others NOT supported: CDBL, CINT, CSNG, DEFFN, FIX, FRE.
5. Normal CASSETTE I/O. (ZBASIC supports it's own SPECIAL CASSETTE I/O statements.)
6. SOME BASIC COMMANDS MAY DIFFER IN ZBASIC. For instance, END jumps to DOS READY, STOP jumps to BASIC READY etc.
7. MEMORY REQUIREMENTS: to approximate the largest BASIC program that can be compiled in your machine (at one time), enter BASIC and type: PRINT (MEM-6500)/2. Remember, you can merge compiled programs together to fill memory.

ZBASIC 2.2 SPEED COMPARISON DEMO

To help give you an idea how fast compiled programs are, we have included this demo program:

ZBASIC 2.2 DEMO PROGRAM

Time to compile and run complete program	**: 0 MIN. 2 SEC.**
BASIC Execution speed MOD 1, LEVEL II	**: 7 MIN. 34 SEC.**
ZBASIC Execution speed MOD 1, LEVEL II	**:0 MIN. 18 SEC.**
BASIC Program size (WITHOUT VARIABLES)	**: 895 BYTES**
ZBASIC Program size (WITHOUT VARIABLES)	**: 2733 BYTES**

(Remember that the ZBASIC program includes an 1879 byte subroutine package.) Program shown exactly as compiled and run in BASIC and ZBASIC.

```
10 '======== ZBASIC 2.2 EXAMPLE PROGRAM AND TIME TEST========
20 CLS:CLEAR100:DEFINT A-X:DEFSTR Z:DIM AA(64,24),Z(50):RANDOM
30 AA=100:BB=-1000:CC=3:DD=-3:EE=-9999:ST$="START TIME "+TIME$
40 FOR I=1TO127STEP2 :FOR J=47TO1STEP-3:XX=POINT(I,J):SET(I,J)
50 XX=(I-J)/CC*(7+I+J) :XX=ABS(INT(RND(I*J)-AA)+7) :RESET(I,J)
60 XX=PEEK(I+J) :POKE15360+I+J,J :OUT255,J AND (3*J):XX=INP(I)
70 AB$=STR$(I+J) :BA$=LEFT$(AB$,2) :AA(I/2,J/2)=VAL(BA$)+AA*3
80 BA$=BA$+RIGHT$(BA$,RND(3)) :XX=INSTR(1,BA$,"9"):XX=SQR(I*J)
90 BA$=MID$(BA$,2,2) :MID$(BA$,1,1)=Z :IF XX THEN 100 ELSE CLS
100 IF LEN(BA$)>3 OR SGN(XX)=1 AND ASC(BA$)=32 THEN PRINT"+++";
110 IFPOS(0)>62 THEN TRON:TROFF:PRINT ELSE XX=NOT(RND(99))+100
120 A$=INKEY$:IF A$="Y" OR A$="y" AND I>120 THEN PRINT"TRUE,."
130 RESTORE :READA,C,Z(J),D:GOSUB170:GOSUB170:GOSUB170:GOTO210
140 NEXT :PRINT"*";:NEXTI:CLS:PRINT@512,ST$,"STOP TIME ";TIME$
150 STOP'============== END OF MAIN TEST LOOP ================
160 DATA 12345,-1,"TEST",-9999
170 ON RND(6) GOTO 180,190,200,180,190,200
180 RETURN
190 RETURN
200 RETURN
210 ON RND(9) GOSUB 180,190,200,180,190,200,180,190,200
220 GOTO140
```

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to disable DEMO/TXT (hold down enter after entering the time), but newcomers to the Model II/12/16 may have to call Micro-Systems or Powersoft for assistance.

Ease of Use

DOS commands and file names are recognized in both upper- and lowercase: stores/dat, STORES/DAT, and StORes/DaT are now the same file. In addition, many characters that were illegal in TRSDOS file names are legal with DOSPLUS II. The file names ACCT#S/DAT and ME&YOU/BAS are examples.

More than one command is allowed on a single line if they are separated with semicolons. For instance, DIR :0 ; FREE :0 ; DIR :1 ; FREE :1, displays directories and free-space maps on drives zero and 1.

Help commands are available for all of the LIB commands and are more complete than those in TRSDOS. Error messages are printed out rather than expressed as numbers. The back-up utility performs both format and backup, eliminating a tedious step.

DOSPLUS II, however, is not always user-friendly. In some instances it fails to provide a list of possible prompt answers, an area where TRSDOS shines. The date and time prompts, for example, are just 'DATE :' and 'TIME :'. When backup encounters a destination disk that is already formatted, it asks 'Diskette contains data, use or not?'. You are not told that Y, U (for use), and N are the correct responses. What's worse is that F is a correct response, too, meaning "Use it, but reformat it first".

Device independence, although a powerful tool, is also confusing. Devicespecs replace switches, so that DIR @PR replaces DIR (P) as a command to print the directory. The Dual command under TRSDOS sends data to both the screen and the printer. Under DOSPLUS the command is replaced by LINK @DO @PR. These commands are fairly easy to learn, but are confusing initially. In addition, some device-independent commands can 'hang' the system if used improperly (more on this later).

Device Independence

The flow of data in a device-independent system can be altered. A sample application is to send the RS-232 input to the printer, or the keyboard input to a disk file. Data is filtered so that certain characters are changed before they reach their destination.

The system defines 16 devices, listed in Table 1. Each is referred to by a name (changeable using the Rename command). The class of a device determines whether it is used for input, output, or both.

Devices zero through seven are referred to as devicespecs, or system devices, while devices eight through 15 are drivespecs, or drive devices. They are preceded in the command line by @ and :, respectively. An example of this is DIR (from) :0 (to) @PR, which sends the directory to the printer (from and to are optional).

You define devices five through seven. This gives you the option of adding peripherals like a joystick, mouse, or plotter. Note that the proper software must be stored in memory by the Set command, and that the hardware may require modifications.

The system devices process data 1 byte at a time, making it possible to send individual bytes from one device to another. The drive devices process data one file at a time. You can send individual bytes from RS-232 port A to the printer, but you cannot send them to drive zero. You could, however, send

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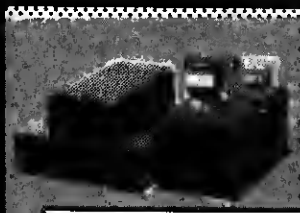

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them to a file on drive zero. This defines a third type of device, called a filespec. Filespecs process data 1 byte/one character at a time (COPY @KI KEYINPUT/TXT:0), or one file at a time (COPY KEYINPUT/TXT:0 NEWFILE/DAT:1).

Five keywords have been added, encompassing most of the device-independent capabilities. They are link, route, reset, filter and set. In addition, the other library commands have been made device-independent.

Link, Route, and Reset

Link connects two output devices to one another so that data going to one is simultaneously sent to the other. You can also link two input devices so that data requested from one can be supplied by the other.

The syntax is link (from) devicespec (to) channel. The devicespec must be one of the system devices (zero through seven); the channel must be byte-oriented (device zero through seven or a filespec). The system prevents you from taking the data from a file, or sending it to a disk. Link by itself displays the current link status of all the devices.

For example, LINK @DO @CA sends data slated for serial port A to the screen, letting you confirm that the appropriate data is sent. LINK @PR PRINT/DAT stores all printer output on disk.

This command will not, however, prevent you from linking an input device to an output device or vice versa, the results of which are unpredictable. In this case, device independence gives you enough rope to hang yourself.

The Route command intercepts data going to a device and sends it elsewhere. Unlike link, the data go only to one device. The syntax is route (from) devicespec (to) channel. Like link, the devicespec must be a system device and the channel either a system device or filespec. Route by itself displays the current status of all the devices.

For example, ROUTE @PR @DO sends all printer data to the screen, and ROUTE @DO @CB intercepts data going to the screen and reroutes it to serial port B.

Reset cancels all linking and routing. The syntax is either reset, which resets all devices, or reset devicespec, which cancels an individual device. Resetting an individual device is also accomplished by linking and routing it to itself (LINK @DO @DO; ROUTE @DO @DO).

Filter

Filter is a powerful tool that captures characters and changes them before they proceed to another device. The syntax is Filter (from) devicespec (to) filespec(on/off). The devicespec indicates which system device (zero through seven) is filtered; the filespec is the file denoting which characters are to be filtered; and the On/Off parameter enables and disables the filter.

Filter can also change your keyboard to the Dvorak configuration. This keyboard configuration, designed in the early 1900s to speed typing, never became popular (see *80 Micro*, December 1980, p. 66). Each character is trapped and assigned a new value before being processed. For instance, Q becomes D, W becomes V, and so on. A filter that does this is included on the DOSPLUS disk.

DOSPLUS II also lets you customize a program to your printer's control codes. The characters that make one printer double-strike might put your printer into a graphics mode or worse. The Filter command lets you trap and change those characters.

Designing a filter file is easy once you decide which characters to trap, and how to change them. A filter-file format looks like this: trapchar = replace char. Trapped and replacement characters can be in ASCII itself or represented by ASCII values. For instance, A = a, 65 = 97, or 41H = 61H are all equivalent. The Build command provides a simple method to write the file.

You can turn a filter file on and off. But regardless of its status, it steals a little memory from your program.

Set

Set installs driver programs for nonstandard peripherals. Usually this is a printer that is not Centronics-compatible or a user-defined device (lightpens and so on). The syntax is Set devicespec (to) filespec.

The driver must be written in machine-language and stored on disk. This is one of the few areas where DOSPLUS requires considerable programming expertise. Its advantage, however, is that it automatically installs the driver, patches it into the system, and protects it from being overwritten. When left to the programmer, these tasks take longer than writing the driver.

Set also restores a device after it has been killed. An example is SET @PR @PR.

Changes in Library Commands

Most library commands are now device-independent. As mentioned earlier,

;	List first line of program
Left arrow	"
/	List last line of program
right arrow	"
down arrow	List next line of program
up arrow	List preceding line of program
!	SYSTEM (!"DIR")
L	LIST (L10-20)
D	DELETE (D10-20)
E	EDIT (E10)
A	AUTO (A10,5)
R or R"	RUN (R"PROGRAM/BAS")
L"	LOAD (L"PROGRAM/BAS")
S"	SAVE (S"PROGRAM/BAS")
K"	KILL (K"PROGRAM/BAS")
.	List current line of program
,	Edit current line of program

Table 2. List of Shorthand Basic Editing Commands

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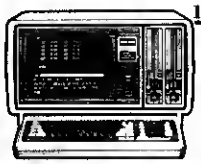

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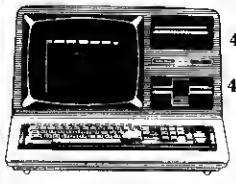

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DIR @PR sends the directory to the printer. DIR @CB sends the directory to serial port A, and DIR DIRFILE/DAT:3 sends it to a disk file. The commands CAT (file catalog, a short form of DIR), List, and LIB are similarly changed.

Commands previously file-oriented are now device-oriented. For instance, Kill now kills a device or drive as well as a file or group of files. If you KILL @PR, data sent to the printer simply disappears. If you KILL :3, data sent to drive three disappears. A subsequent request for data (DIR :3) evokes a 'Device not available' error.

If you Kill the keyboard, you hang the system, and nothing short of a physical reset recovers it.

Copy operates similarly. A device can now be copied to a device as long as both are byte-oriented (zero through seven or a file). You can COPY @KI KEYINPUT/TXT, which saves the keyboard input to a file. The manual claims that COPY @KI @PR turns the printer into a typewriter, but I couldn't get it to work.

A Copy is aborted by pressing the break key, but only after at least one character has been copied. If you copied from an input-only device, you would hang the system. An example is COPY @DO @PR. Again the power of device independence is troublesome.

The Rename command now renames devices and drives as well as files. If you are a CP/M user, you might want to rename your drives A, B, C and D, thereby creating commands like DIR :B.

A few Library commands are dropped or replaced. The Again command is replaced by '/'. Move is replaced by a wildcard option in Copy; Purge is replaced by a wildcard option in Kill. The Echo and Dual commands are gone, victims of device independence. The Receive command, which under TRS-DOS receives object code via the RS-232 port, is gone. There are a few other commands dropped or replaced.

Some Library commands have extra options under DOSPLUS. The Auto command is made unbreakable, so you

	Subroutine is 10 lines from 1st line	Subroutine is 300 lines from 1st line
GOSUB 4000	1.28 minutes	1.53 minutes
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Table 3. Comparing GOSUBs, using Name to GOSUBs using line number, 1,000 iterations

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cannot simply press break to get the DOS ready prompt. It can also be made invisible, so that you see only the results of the commands being executed, instead of the commands themselves. The DIR command can now alphabetically sort the directory before displaying it, and display files fitting a specified wildmask. A sample application takes a directory of all files with the extension /BAS and sorts them before printing them to the screen. The CAT command has the same options.

Copy has an option to copy without using all available memory, making it possible for a large machine-language program to not be overwritten. Forms lets you specify the spool buffer size.

Configuring the Floppy Drives

DOSPLUS II can be configured to use the original Model II drives or the newer, faster, double-sided Model 12 and 16 drives. In addition, you can custom configure the system to deal with almost any disk drive, from a single-density, 35-track, five-inch disk to a 12-megabyte hard disk. This makes DOSPLUS much more flexible than TRSDOS or CP/M, but increases the system's complexity.

The CONFIG command sets both the floppy- and hard-disk drive parameters. The syntax is: CONFIG drivespec (parameter, parameter,...), where drivespec is the drive being configured.

The floppy drive parameters include software write protect, motor on delay (used for the Model 12/16), head load delay, and step speed (the rate at which the drive moves between tracks). The density (single or double) and the number of sides (one or two) are set with the Format utility. The system also supports five- or eight-inch drives, although the hardware does not exist for attaching a five-inch drive to the Model II/12/16.

DOSPLUS II is configured for a Model II with four eight-inch drives and uses a slow step speed (30 milliseconds). Model II users with Radio Shack drives should change the step speed to 6 milliseconds.

The manual is confusing on the use of the head-load delay parameter, at one point stating that it's used with Radio Shack Model II drives and later reversing itself. Micro-Systems Software informed me that this parameter is necessary for the Model II Drive zero only.

Model 12/16 owners with standard Radio Shack drives must change the motor-on-delay to Y and can change the step speed to 3 milliseconds. This is made easy with the MOD16/CMD file included on the disk. *80 Micro* has tested this system on the Model 12 and it performed flawlessly.

The CONFIG command also changes the order in which your drives are scanned during a file search. This is useful if you are using hard disks and wish to search them before the floppies.

Configuring for Hard Disk

Hard disk drives are fully supported, and are usually referred to as drives four through seven. As shipped, these devices are set to NIL and must be turned on by setting them to themselves. For instance, SET :4 :4 enables drive 4.

The Rigid parameter of the CONFIG command informs the system that it is a hard disk. Both five- and eight-inch hard drives are supported in hardware and software. You can also indicate fixed or removable platters and software write-protection. You must specify the step, head count, and track size; these parameters are included in your hard-disk manual.

"DOSPLUS II can be configured to use the original Model II drives or the newer, faster, double-sided Model 12 and 16 drives."

In addition, CONFIG partitions one physical hard disk drive into two or more logical drives. This is useful to double the directory size, thereby allowing for more, but shorter, files. Three parameters must be set to do this, and failure to set them correctly results in two logical drives accessing the same track, a disastrous situation.

The number of cylinders on a drive and the number of platters also have to be set when formatting the drives with the RFORMAT utility. If you format too many cylinders, you may invade the wrong logical drive and wreak havoc.

The instructions for using hard drives are scattered throughout the manual. The section on CONFIG gives you the actual parameters to set, while the technical section tells you how to use them most effectively. In addition, you are referred to the Set command to enable the drive, the RFORMAT command to format it, the SYSGEN command to make it an operating system disk, and the System command to save the configuration to disk. At some point you must calculate the best values for all the hard disk parameters, being sure to use the disk effectively but not overlapping logical drives. This procedure is not for the faint-hearted.

The section on CONFIG does advise you on two configurations for the Radio Shack 8.4-megabyte drives, and Micro-Systems advised me that sample configurations for the new 12-megabyte units are on the way. The Do files, which initialize and configure the 8.4-megabyte drives, are included on the disk, but you must read the section on SYSGEN to realize this. If you miss this you'll have to type up to 13 commands, some of them quite long (four Sets, four CONFIG commands, four RFORMATs and one System command).

Using Different Configurations

The System command allows niceties like deleting the DOSPLUS II graphics display and Time and Date prompts at power up. In addition, a trace function displays the Z80 program counter in the upper right-hand corner of the screen. This is a godsend for the machine-language programmer who wants to know the memory address being executed. The alive function places a blinking graphics character in the upper right-hand corner, indicating that the interrupts are functioning and that the system is not "hung."

The system (SAVE = file name) function is the most powerful feature of the DOSPLUS configuration system. It lets you save all of the system and CONFIG parameters, as well as the printer's forms setup, linking, filtering and routing, and device names.

In short, the current state of the system is saved to a /CMD file (MOD 16/CMD is an example). You can save as many of these files as you like, making it possible to configure your system for an endless number of situations.

For instance, if you do a lot of machine-language programming, you might save a file that turns on the trace function, protects 16K in high memory, and links the video to the printer so you have a printed record of the screen. If you want to use your system as a dumb terminal, set up the proper route and link parameters and save them in the file DUMB/CMD. The applications are endless.

Utilities

DOSPLUS II has 13 utilities to TRSDOS 2.0a's six. The added utilities

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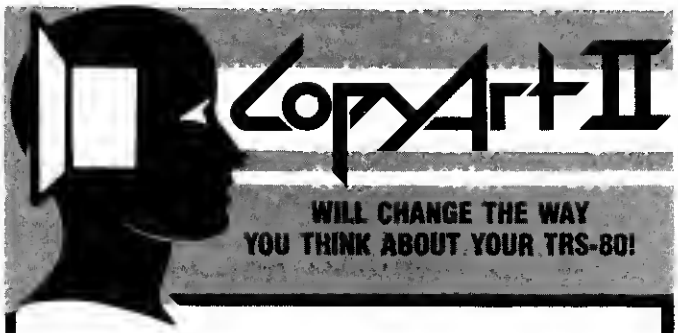

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include two disk-repair programs, a disk zapper, an editor/assembler, and a TRSDOS-to-DOSPLUS conversion program.

The old standbys Backup and Format are here, in addition to RFORMAT for formatting the hard drives. Backup only duplicates floppies; hard-disk backups are not possible. The manual suggests using the Copy command to copy files from a hard disk.

SYSGEN is familiar to Model I/III DOSPLUS users. It lets you make almost any disk an operating system disk. Specifically, it creates double-sided floppy system disks for Model 12/16 owners, and hard system disks for hard-disk owners. The utility is simple to use, and the instructions are explicit.

Two programs are included to repair disks that are damaged. They are DIRCHECK, which checks the directory for errors, and DIRFIX, which fixes them. These utilities require little or no knowledge of directory structure. They do not, however, fix unreadable sectors on the disk.

Directory failures are caused by operator errors or a bad disk, but they can also be caused by a faulty operating system. I encountered one directory error that DIRFIX fixed easily, but I could not blame it on the operator or a faulty disk. If this is due to a bug in DOSPLUS, then a patch should follow soon.

Diskzap is a disk zapper with seven options. You must use the Set option to inform Diskzap of the type of disk in each drive. The display option lets you display and modify sectors. Other options include fill sector with a specified byte, copy sector to sector, and verify sectors, which checks for unreadable portions of the disk. Used in the right hands, this zapper is a powerful tool for repairing blown disks.

The EDAS editor/assembler from Galactic Software is included free. Used in conjunction with the manual's technical section, it can write machine-language programs. Editing commands include search and replace. Assembly options include assembly to RAM, which allows you to execute newly created code, and immediate jump back to the EDAS. The original Galactic documentation is included.

TRSDOS Compatibility: CONV and SVCINT

The plethora of TRSDOS software for the Model II/12/16 makes TRSDOS compatibility a must for any new operating system. DOSPLUS II includes two utilities to make this possible.

The TRSDOS and DOSPLUS formats are different, making it impossible to read one with the other. The CONV utility, however, makes it possible to read TRSDOS 1.2 or 2.0 files and copy them to a DOSPLUS disk. Options include taking a directory of the TRSDOS disk and copying files back to TRSDOS. These two options are unique among DOS conversion programs.

The manual does not state the differences between the TRSDOS and DOSPLUS formats. Micro-Systems told me that DOSPLUS uses 30 sectors/track compared to TRSDOS' 25, yielding a 20 percent increase in disk space.

"Micro-Systems has informed me that future updates and releases will include TRSDOS Basic, making it possible for one-drive users to perform the patch."

The SVC calls (similar to ROM routines on the Model I/III) are mostly TRSDOS compatible, but some existing programs require full compatibility. The SVCINT utility provides this by intercepting certain routines in DOSPLUS and making them conform to TRSDOS. This is sufficient in most cases. In addition, patches are provided for the ST80III (a terminal program), Profile Plus (a data-base manager), and VisiCalc.

Other utilities include Draw, enabling you to use the screen as a graphics scratchpad, and Offset, allowing you to relocate machine language in memory. The MEMTEST and terminal programs are not found on DOSPLUS II, but they might function correctly once you transfer them from TRSDOS.

Enhancements to Basic

Rather than supply their own version of Basic, the DOSPLUS creators opted to transfer Basic from TRSDOS to DOSPLUS and then patch it. This is a simple, well-documented process, but requires at least two drives. It only needs to be done once. The improvements to Basic include more editing commands, the ability to reference line numbers with labels, and an increase of 4K in user space.

Micro-Systems has informed me that future updates and releases will include TRSDOS Basic, making it possible for one-drive users to perform the patch.

Model I/III users are familiar with most of the edit commands. They include one-character abbreviations like '!' for System and 'E' for Edit. Table 2 provides a complete list.

Three utilities are called into Basic via SYSTEM"file name". REF/CMD finds all references to variables, line numbers, and keywords. The SR/CMD utility lets you search and replace strings.

The SORT/CMD utility is the most powerful sort utility to be included on any TRS-80 operating system. It sorts variable, integer, and single- and double-precision arrays of any length. In addition, you may sort up to 30 specified arrays. The first 10 are key arrays that determine the order in which something is sorted.

If two items in the first key array are equal, the sort goes to the second array, and so on. You can specify up to 20 tag arrays, which are along for the ride. When two elements of a key array are swapped, the corresponding elements in the tag array are also swapped.

The Name command is used under TRSDOS to rename disk files, but under DOSPLUS II it enables you to assign a name to a line number, and then reference it by that name. GOSUB 12560 can now read GOSUB SORT, or GOSUB GETKEY. Use the name statement in the line number you wish to reference, then GOTO and GOSUB it by name instead of number. Program Listing 1 is a sample application. Use the SYSTEM"RENAME" command to rename files under DOSPLUS II.

Name eliminates the need to memorize important line numbers and makes the code easy to read. I have a couple of reservations, however. The documentation states that you can place the Name label statement anywhere in the program line, but I found that it must be the first statement in the line. Program execution is slowed down, because the GOTO and GOSUB search routines must search the code instead of just the line numbers.

This speed reduction is greater when the referenced line is farther from the first line of the program. Table 3 shows sample timings for subroutines that are the 11th and 301st program lines. Program Listing 2 tests the GOSUB Exam-

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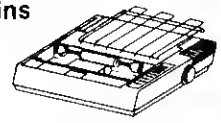

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ple statement when it is the 11th line.

The improved editing features and DOSPLUS-to-TRSDOS conversion make DOSPLUS II a great way to develop commercial Basic programs for use under TRSDOS. This is made difficult, however, by the Name command. A program to convert back to the standard line-number referencing would solve this problem as well as the speed problem. Its absence is puzzling in a system as complete as this one.

DOSPLUS makes an extra 4,000 bytes available to Basic programs, as well as to applications programs like VisiCalc. This feature alone may make DOSPLUS worth the price.

The documentation only covers TRSDOS Basic enhancements. Programmers have to keep the Tandy manual by their side.

Documentation

The documentation is attractively packaged, and lengthy, but suffers from poor organization and is sometimes inaccurate.

The manual is organized into DOS operations, library commands, utilities, Basic, and technical information. Each section is separated by a blank

```
10 '*** EXAMPLE OF NAME COMMAND IN ACTIO
N ***
20 GOTO START
30 NAME FIRST:PRINT"FIRST SUBROUTINE":RE
TURN
40 NAME SECOND:PRINT"SECOND SUBROUTINE":
RETURN
50 NAME THIRD:PRINT"THIRD SUBROUTINE":RE
TURN
60 NAME FOURTH:PRINT"FOURTH SUBROUTINE":
RETURN
70 NAME FIFTH:PRINT"FIFTH SUBROUTINE":RE
TURN
99 '*** MAIN ROUTINE ***
100 NAME START
110 FOR X=1 TO 5
120  ON X GOTO GO1,GO2,GO3,GO4,GO5
130  NAME GO1:GOSUB FIRST:GOTO LOOP
140  NAME GO2:GOSUB SECOND:GOTO LOOP
150  NAME GO3:GOSUB THIRD:GOTO LOOP
160  NAME GO4:GOSUB FOURTH:GOTO LOOP
170  NAME GO5:GOSUB FIFTH
180 NAME LOOP:NEXT X
190 END
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Program Listing 1

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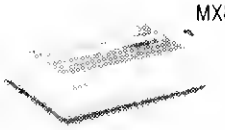

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page and a colored tab, and begins with a list of the features covered. A table of contents lets you look up individual commands.

After this, however, the organization suffers. A software product of this complexity needs an index referencing all commands. In addition, the commands within each section are listed alphabetically, instead of in logical order. For instance, device-independent commands like Link, Route, Set, and Reset are scattered among 34 other commands. The hard-disk and configuration commands like CONFIG, Set, SYSGEN, System, and RFORMAT are spread throughout the manual. Concepts like these are abstract enough without poor organization making comprehension harder.

The first four sections of the manual are thorough, but have some inaccuracies. At one point the manual states that DOSPLUS II does not maintain the system date as a file attribute, but I found that it does. One of the suggested device-independent uses for Copy does not work, nor does the Name command unless it is the first statement in a line.

The technical section is one of the best I have seen. Twenty-six pages are devoted to general system operation, while a whopping 91 pages document the SVC calls. In all, this section is 127 pages long. It makes DOSPLUS II an excellent package for software development.

Technical Support

Micro-Systems and Powersoft are established companies with good track records in customer support. Once you send in the registration card, you are notified of any system upgrades. Both companies provide customer support, so you can call one of two phone numbers (neither toll-free) or write to one of two addresses.

Both companies can be reached on CompuServe's MicroNet and Special Interest Group (SIG) menus. In addition, Micro-Systems publishes *The DOSPLUS Quarterly* with hints and tips on using their operating system.

The Micro-Systems/Powersoft team will soon send out an updated disk to registered owners fixing all known errors, including bugs in the CONV and Diskzap utilities. This version should be even more TRSDOS-compatible than the last one.

DOSPLUS II is the most powerful Z80 operating system available for the Model II/12/16. Its device-independence makes it a superb programming tool, as does its editor/assembler and enhanced Basic. The documentation is thorough, though slightly disorganized. If you want more out of your II/12/16, try DOSPLUS II.■

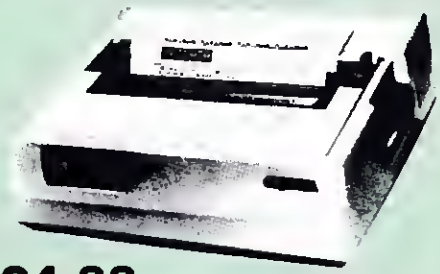
Art Huston can be reached at 23 Granite St., Peterborough, NH 03458.

```
10 'BENCHMARK - NAME STATEMENT FROM DOSP
LUS II VS. GOTO AND GOSUB LINE NUMBER
        THIS IS NAME VERSION, SUBROUTINE
 10 LINES FROM START
20 CLS:SYSTEM"TIME 00.00.00":GOTO 50000
'BYPASS DUMMY LINES AND SUBROUTINE
30 'LINES 40 - 100 ARE DESIGNED TO MAKE
THE INTERPRETER LOOK FOR THE NAME
        IN AN AVERAGE LENGTH LINE
40 PRINT@0,CHR$(24):X=SQR(2):Y=INT(X*100
0/256):FORX=1TO100:PRINTA$(X):NEXT:A$=IN
PUT$(1):ONYGOSUB1000,2000,3000:GOTO4000:
IFY>0THEN2000ELSEFORZ=1TOY:GET#1,Z:NEXT
50 PRINT@0,CHR$(24):X=SQR(2):Y=INT(X*100
0/256):FORX=1TO100:PRINTA$(X):NEXT:A$=IN
PUT$(1):ONYGOSUB1000,2000,3000:GOTO4000:
IFY>0THEN2000ELSEFORZ=1TOY:GET#1,Z:NEXT
60 PRINT@0,CHR$(24):X=SQR(2):Y=INT(X*100
0/256):FORX=1TO100:PRINTA$(X):NEXT:A$=IN
PUT$(1):ONYGOSUB1000,2000,3000:GOTO4000:
IFY>0THEN2000ELSEFORZ=1TOY:GET#1,Z:NEXT
70 PRINT@0,CHR$(24):X=SQR(2):Y=INT(X*100
0/256):FORX=1TO100:PRINTA$(X):NEXT:A$=IN
PUT$(1):ONYGOSUB1000,2000,3000:GOTO4000:
IFY>0THEN2000ELSEFORZ=1TOY:GET#1,Z:NEXT
80 PRINT@0,CHR$(24):X=SQR(2):Y=INT(X*100
0/256):FORX=1TO100:PRINTA$(X):NEXT:A$=IN
PUT$(1):ONYGOSUB1000,2000,3000:GOTO4000:
IFY>0THEN2000ELSEFORZ=1TOY:GET#1,Z:NEXT
90 PRINT@0,CHR$(24):X=SQR(2):Y=INT(X*100
0/256):FORX=1TO100:PRINTA$(X):NEXT:A$=IN
PUT$(1):ONYGOSUB1000,2000,3000:GOTO4000:
IFY>0THEN2000ELSEFORZ=1TOY:GET#1,Z:NEXT
100 PRINT@0,CHR$(24):X=SQR(2):Y=INT(X*10
00/256):FORX=1TO100:PRINTA$(X):NEXT:A$=I
NPUT$(1):ONYGOSUB1000,2000,3000:GOTO4000
:IFY>0THEN2000ELSEFORZ=1TOY:GET#1,Z:NEXT

40000 NAME EXAMPLE 'THIS IS THE EXAMPLE
SUBROUTINE
40010 PRINTUSING"EXECUTING THE SUBROUTIN
E FOR THE ##### TIME";X
40020 RETURN
50000 '*** MAIN (CONTROLLING) ROUTINE **
*
50010 'GOSUB THE SUBROUTINE 1000 TIMES
50020 FOR X=1 TO 1000
50030  GOSUB EXAMPLE
50040 NEXT X
50050 PRINT"DONE"
50060 PRINT"TIME IS - "TIME$
50070 END
```

Program Listing 2

Okidata ***MICROLINE 92***



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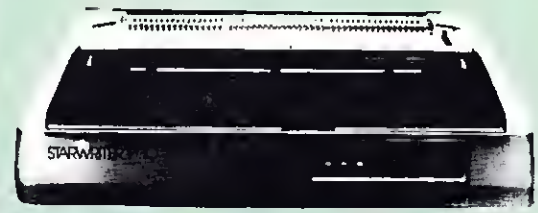

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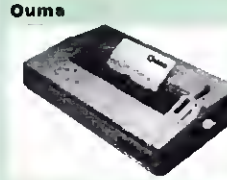

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Photo 2

If your Color Computer screen can't handle detailed graphics, try this graphics editor.

I have written many graphics programs for my Color Computer, but until recently have had a hard time creating detailed graphics. I solved this problem by writing a graphics editor program designed for 32K computers.

My graphics program is simple in concept, but is a powerful utility. Drawings are created on the low-resolution screen and are then transferred to the 64-by-32-character area of the highest resolution screen. This is done with a For...Next loop that reads each point on the low-res screen and sets the identical pattern on the high-res screen.

The program consists mainly of two subroutines, one to locate an area of the high-res screen and one to edit the picture.

Before transferring the picture, an area is chosen in which to place the picture. The first subroutine positions the picture using the commands Get and Put. You will see a flashing rectangle

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The LAZYFONT package includes a program for creating the fonts, which lets you draw characters on the screen, then save them to disk. You can draw any sort of character, including logos and pictures. A bonus for users who don't want to draw their own fonts is that you can use GEAP/DotWriter fonts with this program.

LAZYFONT is available from AlphaBit Communications for $49.95. The present version works only with the Epson MX-80 or MX-100 with Graftrax or Graftrax Plus. Versions for other dot matrix printers will be available soon.

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This revolutionary product is available from AlphaBit Communications, Inc. for $49.95. You're reading a sample now, printed with the TITLE typeface.

****

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which is a 64-by-32 area of the high-res screen into which your picture will be placed. Move this area with the joystick until you have found the spot where you wish your picture to be placed, then press the joystick fire button and that portion of the screen is transferred to the low-res screen.

A picture is created by using arrow keys to move a flashing white dot around the screen, setting and resetting points where needed. As you draw the picture on the low-res screen, it is simultaneously transferred to the high-res screen. As your design takes shape, press the O key to see what your picture looks like on the high-res screen. When your picture is finished, press the O key to stop.

Your drawing is now on PMODE 4,1 with SCREEN 1,1. The colors for this mode are black and buff, but red and blue may also be created. In the low-res

"Press the O key to see what your picture looks like on the high-res screen."

picture you see vertical stripes on either side of the word "THE." These stripes, when transferred to the high-res screen, appear blue. To create the color red, reverse the stripes.

Two nice subroutines are available as you design your picture. If you press X, a text line appears at the top of the screen. This line provides the X and Y coordinates of the flashing dot on the high-res screen. If you press the B key, you see a line eight points long. By pressing the arrow keys, the line moves across the screen in intervals of eight and down the screen in intervals of one. This line represents the memory location or byte where the information is stored. If you press the X key, the text line appears giving you the memory location and the decimal value of this byte. This last subroutine may mean nothing to some of you but is very useful in working with memory areas of the graphics screen. To exit this subroutine, push the Q key and you return to the normal edit mode.

Program Listing

```
10 DIM VT(4,4),VU(4,4)
20 DIM GZ(32)
30 DIM VV(63,31)
40 PMODE 4,1
50 CLS
60 PRINT@224,"<1> EDIT PICTURE OR <2> TRANSFER"
70 A$=INKEY$:IF A$="" THEN 70
80 ON VAL(A$) GOTO 560,100
90 GOTO 70
100 REM TRANSFER PICTURE
110 SCREEN 1,1
120 GOTO 140
130 PUT(L,M)-(L+4,M+4),VT,PSET
140 J=JOYSTK(0):K=JOYSTK(1)
150 L=J*3:M=K*2.5
160 GET(L,M)-(L+4,M+4),VT,G
170 PUT(L,M)-(L+4,M+4),VT,PRESET
180 P=PEEK(65280)
190 IF P=126 THEN 220
200 IF P=254 THEN 220
210 GOTO 130
220 REM GET NEXT POINT
230 LA=L:MA=M
240 J=0:K=0
250 GOTO 270
260 PUT(L+J-4,M+K-4)-(L+J,M+K),VU,PSET
270 J=JOYSTK(0)
280 K=JOYSTK(1)
290 IF K>31 THEN K=31
300 GET(L+J-4,M+K-4)-(L+J,M+K),VU,G
310 PUT(L+J-4,M+K-4)-(L+J,M+K),VU,PRESET
320 P=PEEK(65280)
330 IF P=126 THEN 360
340 IF P=254 THEN 360
350 GOTO 260
360 REM FIND TRANSFER POINT
370 PUT(LA,MA)-(LA+4,MA+4),VT,PSET
380 PUT(L+J-4,M+K-4)-(L+J,M+K),VU,PSET
390 REM J=J+4 ETC
400 GOTO 420
410 PUT(L,M)-(L+J,M+K),VV,PSET
420 JA=JOYSTK(0):KA=JOYSTK(1)
430 L=JA*3:M=KA*2.5
440 GET(L,M)-(L+J,M+K),VV,G
450 PUT(L,M)-(L+J,M+K),VV,PRESET
460 P=PEEK(65280)
470 IF P=126 THEN 500
480 IF P=254 THEN 500
490 GOTO 410
500 REM MOVE PICTURES
510 PUT(L,M)-(L+J,M+K),VV,PSET
520 GET(LA,MA)-(LA+J,MA+K),VV,G
530 PUT(L,M)-(L+J,M+K),VV,PSET
540 IF INKEY$="" THEN 540
550 RUN
560 REM ENLARGE PICTURE
570 CLS(RND((9)-1))
580 PRINT@43,"HELP MENU";
590 PRINT@101,"X - SHOW INFO WINDOW";
600 PRINT@133,"B - SHOW WHICH BYTE ";
610 PRINT@165,"S - SET A POINT     ";
620 PRINT@197,"R - RESET A POINT   ";
630 PRINT@229,"Q - QUIT            ";
640 PRINT@261,"O - SEE SCREEN      ";
650 PRINT@293,"CL- CLEAR SCREEN    ";
660 PRINT@451,"PRESS ANY KEY TO CONTINUE";
670 IF INKEY$="" THEN 670
680 GOSUB 780:REM GET POSITION
690 SCREEN 0,0
700 CLS
710 FOR XX=0 TO 63
720 FOR YY=0 TO 31
730 IF PPOINT(LL+XX,MM+YY)=1 THEN SET(XX,YY,5) ELSE RESET(XX,YY)
740 NEXT YY,XX
750 SCREEN 0,0
760 REM TRANSFER PICTURE
770 GOTO 950
780 PMODE 4,1:REM GET POSITION
790 GET(LL,MM)-(LL+63,MM+31),VV,G
800 SCREEN 1,1
810 PUT(LL,MM)-(LL+63,MM+31),VV,PSET
820 SCREEN 1,1
830 JJ=JOYSTK(0)
840 IF JJ>25 THEN JJ=25
850 KK=JOYSTK(1)
860 LL=JJ*8:MM=KK*2.5
870 GET(LL,MM)-(LL+63,MM+31),VV,G
```

Listing continues

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Another program option is the ability to transfer portions of the screen to other areas. When you exercise this option, a flashing square appears on the high-res screen. Using the joystick, move this square to the upper left-hand corner of the area you wish to transfer and press the fire button. A second square then appears. Move this square to the lower left-hand corner of the area you wish to transfer. (There is a limit as to how far this second square goes. Too little memory exists to transfer larger areas with this method of transfer.)

Once you mark this second area, a large flashing rectangle appears. This rectangle is the same size you marked off for transfer. Move this rectangle to your transfer destination and press the fire button. The transfer appears: Push any key to return to the menu.

"I produced my castle and dragon in one evening."

Once you create some of your own pictures, you may wish to save them. To do so, first break from the program and then load a cassette tape for recording. Next, type CSAVEM"SCREEN", 1536,7679.0, press enter and your picture is recorded. To get your picture back again, type CLOADM"SCREEN" and press enter. You may find after you load the program that the colors blue and red have reversed. To correct this you may have to push the reset key several times, checking the color of the screen each time, to get the colors normal.

This program is easily modified to develop a personalized graphics program. Graphics can be created quickly; I produced my castle and dragon in one evening. I added this program to one of my screen graphics programs to create a powerful utility. ■

Wayne Thume can be reached at R2, Box 119, Trappe, MD 21673.

Listing continued

```
880 PUT(LL,MM)-(LL+63,MM+31),VV,PRESET
890 PP=PEEK(65280)
900 IF PP=126 THEN 930
910 IF PP=254 THEN 930
920 GOTO 810
930 PUT(LL,MM)-(LL+63,MM+31),VV,PSET
940 RETURN
950 REM CHANGE PICTURE
960 JJ=0:KK=0
970 CC=POINT(JJ,KK)
980 GOSUB 1550
990 FZ=0
1000 CB$=INKEY$
1010 SET(JJ,KK,5)
1020 RESET(JJ,KK)
1030 IF CB$="" THEN 1000
1040 IF CC=0 THEN RESET(JJ,KK) ELSE SET(JJ,KK.5)
1050 IF CB$=CHR$(94) THEN KK=KK-1
1060 IF CB$=CHR$(10) THEN KK=KK+1
1070 IF CB$=CHR$(8) THEN JJ=JJ-1
1080 IF CB$=CHR$(9) THEN JJ=JJ+1
1090 IF KK<0 THEN KK=31
1100 IF KK>31 THEN KK=0
1110 IF JJ>63 THEN JJ=0
1120 IF JJ<0 THEN JJ=63
1130 IF CB$="Q" THEN RUN
1140 IF CB$="O" THEN GOSUB 1600
1150 IF POINT(JJ,KK)=0 THEN CC=0 ELSE CC=1
1160 IF CB$="B" THEN GOSUB 1250
1170 IF CB$="P" THEN CC=1:PSET(LL+JJ,MM+KK)
1180 IF CB$="C" THEN GOSUB 1650
1190 IF CB$="R" THEN PRESET(LL+JJ,MM+KK):CC=0
1200 IF CB$="X" THEN GOSUB 1480
1210 IF CB$="H" THEN GOSUB 570
1220 IF FZ=1 THEN PRINT@0,"X=";INT(LL+JJ);"Y=";INT(MM+KK)
1230 SET(JJ,KK,5)
1240 GOTO 1000
1250 REM SHOW BYTE
1260 CZ=0:AX=0:BZ=0
1270 DZ=0
1280 JZ=1536+(INT(MM)*32)+(LL/8)
1290 FOR AX=0 TO 7
1300 IF POINT(DZ+AX,BZ)=5 THEN RESET(DZ+AX,BZ) ELSE SET(DZ+AX,BZ
,5)
1310 NEXT
1320 DA$=INKEY$:IF DA$="" THEN 1320
1330 FOR AX=0 TO 7
1340 IF POINT(DZ+AX,BZ)=5 THEN RESET(DZ+AX,BZ) ELSE SET(DZ+AX.BZ
,5)
1350 NEXT
1360 IF DA$=CHR$(94) THEN BZ=BZ-1:JZ=JZ-32
1370 IF BZ<0 THEN BZ=0:JZ=JZ+32
1380 IF DA$=CHR$(10) THEN BZ=BZ+1:JZ=JZ+32
1390 IF BZ>31 THEN BZ=31:JZ=JZ-32
1400 IF DA$=CHR$(8) THEN DZ=DZ-8:JZ=JZ-1
1410 IF DZ<0 THEN DZ=DZ+8:JZ=JZ+1
1420 IF DA$=CHR$(9) THEN DZ=DZ+8:JZ=JZ+1
1430 IF DZ+7>63 THEN DZ=DZ-8:JZ=JZ-1
1440 IF DA$="Q" THEN GOSUB 1480:RETURN
1450 IF DA$="X" THEN GOSUB 1480
1460 IF FZ=1 THEN PRINT@0,"LOCATION =";JZ;"VALUE =";PEEK(JZ)
1470 GOTO 1290
1480 IF FZ=1 THEN GOSUB 1500 ELSE GOSUB 1550
1490 RETURN
1500 FOR X=0 TO 31
1510 POKE 1024+X,GZ(X)
1520 NEXT
1530 FZ=0
1540 RETURN
1550 FOR X=0 TO 31
1560 GZ(X)=PEEK(1024+X)
1570 NEXT X
1580 FZ=1
1590 RETURN
1600 REM SEE HI-RES SCREEN
1610 SCREEN 1,1
1620 IF INKEY$="" THEN 1620
1630 SCREEN 0,0
1640 RETURN
1650 FOR HU=1 TO 100
1660 CB$=INKEY$
1670 IF CB$="L" THEN 1700
1680 NEXT HU
1690 RETURN
1700 CLS0
1710 LINE(LL,MM)-(LL+63,MM+31),PRESET,BF
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```

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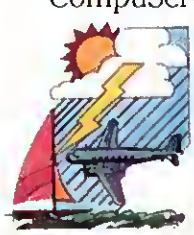

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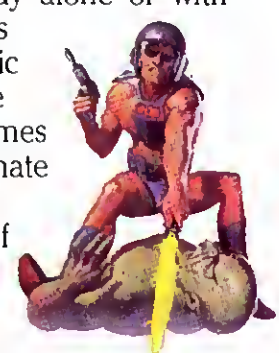

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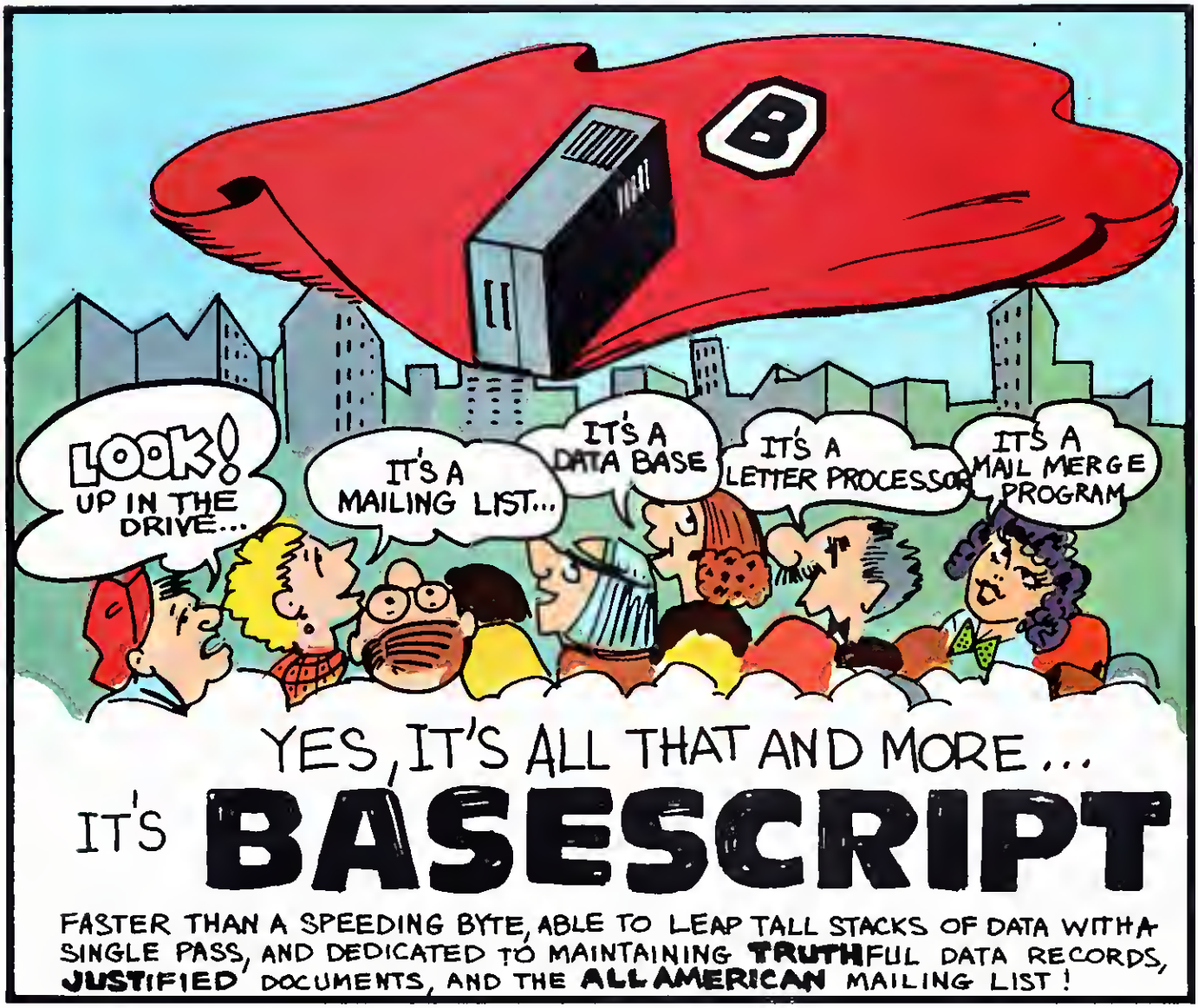

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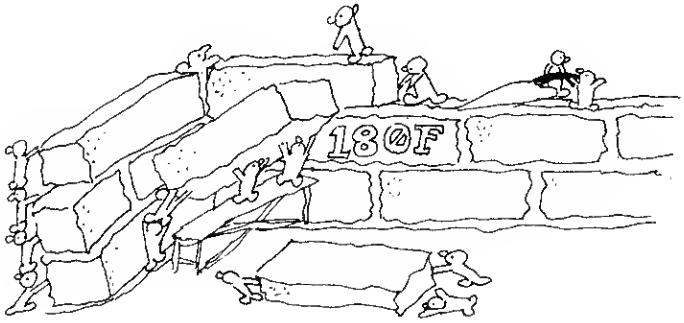
Assembly-Language Shortcuts Part I



by Bob Bowker

Bowker introduces his series of articles with simple tricks and shortcuts to make writing Assembly-language programs an easier process.

I recently rewrote a disk-directory program that I coded two years ago. The awkwardness of that original prompted me to share some of what I've learned. I had to fit a program in a finite number of bytes—in a 1K EPROM, for example, or in the SYS overlay area—so I devised some shortcuts; byte-saving is the mother of many inventions. I don't claim to be the author of all these tricks, however, just a collector.

We'll start with a simple one; the ROM subroutine at 0060H is one of the best-known among Assembly-language programmers. Load a count in the BC register pair, and call 0060H; a delay will occur, depending on the value in BC. For example, see Program Listing 1. In a standard Model I, this routine will cause a delay of 937.6 microseconds.

However, look at Program Listing 2. This routine will also cause a delay of 937.6 microseconds, and it's 2 bytes shorter. As long as your delays are under 1,175 μs (B=0FFH), why not?

```
016400   00100  DELAY  LD     BC,0064H   ;Delay length
CD6000   00110         CALL   0060H      ;ROM's delay loop
```

Program Listing 1

```
0664     00100  DELAY  LD     B,0CCH     ;Delay length
10FE     00110  LOOP   DJNZ   LOOP
```

Program Listing 2

```
0E04     00100  PROG   LD     C,04H      ;Counter = 4
06FF     00110  PROG1  LD     B,00H      ;counter = 256
7E       00120  LOOP   LD     A,(HL)     ;Get character
FE80     00130         CP     80H        ;Is it a graphic?
3802     00140         JR     C,NEXT     ;Go if not
3E2E     00150         LD     A,2EH      ;Substitute a dot
CDxxxx   00160  NEXT   CALL   PRINTR     ;Print it
23       00170         INC    HL         ;Point to next one
10F3     00180         DJNZ   LOOP       ;. . .and loop
0D       00190         DEC    C          ;Count this one too
20EE     00200         JR     NZ,PROG1   ;. . .and Keep going
```

Program Listing 3

Again, and Again, and Again

DJNZ is a new command in the Z80; it doesn't exist in the instruction sets of the 8080 or its other ancestors. It allows you to loop through a section of code up to 256 times. To increase the number of loops, try Program Listing 3.

The Key Box

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This routine is a crude screen-print program. The DJNZ causes 256 loops through the code, while lines 190–200 reset the DJNZ counter, the B register, four times. As long as PRINTR doesn't destroy the BC register pair, this routine takes care of all 1,024 bytes on the screen.

Simple Arithmetic

The ROM routines for arithmetic are there and are relatively easy to use. Often, however, there's no need to save and set up all the registers necessary to simply double a number, or multiply it by another number, provided you're sure the result won't overflow the registers you're using.

For example, Program Listing 4 doubles a number. Program Listing 5 gives a result five times that same number. It's just 4 bytes long! Remember that your starting number can't exceed 51, or the A register will overflow and the results will be unpredictable.

Multiplying by 10 takes only 1 more byte. (See Program Listing 6.) Remember that your starting number must now be 25 or less to avoid overflow. If you just can't stay under 255, but 65535 is high enough, use the HL register instead of A above, and BC or DE instead of B. This is a few more bytes, but still shorter than using the ROM routines.

Keep the Flags Flying

Basic has the command ON... GOTO, and for a time I wrote routines that were hundreds of bytes long to do the same thing in machine language. It was some time before I found the commands Set, RES, and RRCA, and learned how to use flags to do the job.

"You can use the Set command to make a single byte into eight flags for eight different parameters..."

You can use the Set command to make a single byte into eight flags for eight different parameters or events. If the parameter or event is to happen, assign 1 bit to it and set it. Once it's happened, RES the same bit and the flag is off.

The tricky part is checking the bits to see if they're on or off. You could always use "BIT ×,A", but that command is 2 bytes long. RRCA, however, is only 1, and has the added advantage of setting things up for a conditional Call or Jump.

For example, if bit zero of the flag's byte is set, the RRCA command will rotate it into Carry flag, which is one of the conditionals. You can then "CALL C,xxxx" or "JP C,xxxx".

Suppose you have a program that can pass parameters in the command line, such as "XDIR ISP". In this case, you want to run a program called XDIR, and print out the list of all invisible and system file names. If HL points to the "ISP," calling the subroutine in Program Listing 7 will set flags for each of the parameters requested. When it comes time to execute these parameters, you can do it via Program Listing 8.

The RRCA concept is not limited to the A register; you can use any register you want, such as "RRC B" or "RRC C". You can also apply it to the contents of a RAM address using "RRC (HL)", and "RRC (IX + d)" or "RRC (IY + d)". You don't have to go right all the time either: RLCA duplicates RRCA, but to the left—ditto for

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"RLC B", "RLC C", "RLC (HL)", and so on.

More Bits and Bytes

My early attempts at Assembly-language programming avoided entire groups of Z80 instructions because I didn't understand them. I would write the longest routines to avoid using such commands as "AND 6DH" and "OR E". Eventually, I learned how to use the Boolean logical operators.

```
87      00100   DUBL    ADD     A,A         ;Add A to itself
```

Program Listing 4

```
47      00100   XFIVE   LD      B,A         ;Store the number
87      00110           ADD     A,A         ;Double it...
87      00120           ADD     A,A         ;Double double = ×4
80      00130           ADD     A,B         ;...plus 1 makes 5.
```

Program Listing 5

```
87      00100   XTEN    ADD     A,A         ;Double it...
47      00110           LD      B,A         ;Store 2X
87      00120           ADD     A,A         ;...times 4
87      00130           ADD     A,A         ;...times 8
80      00140           ADD     A,B         ;...and 2 makes 10.
```

Program Listing 6

```
0600    00100   PARSE   LD      B,00H       ;Zero the flag
7E      00110   LOOP    LD      A,(HL)      ;Get parameter
FE0D    00120           CP      0DH         ;Carriage Ret?
281B    00130           JR      Z,DONE      ;Done if yes
FE49    00140           CP      49H         ;Is it an "I"?
280B    00150           JR      Z,ITSI
FE53    00160           CP      53H         ;Is it an "S"?
280B    00170           JR      Z,ITSS
FE50    00180           CP      50H         ;Is it a "P"?
280B    00190           JR      Z,ITSP
23      00200   BACK    INC     HL          ;Point to next one
18EC    00210           JR      LOOP        ;...and check it
CBC0    00220   ITSI    SET     0,B         ;Set the "I" flag
18F9    00230           JR      BACK
CBC8    00240   ITSS    SET     1,B         ;Set the "S" flag
18F5    00250           JR      BACK
CBD0    00260   ITSP    SET     2,B         ;Set the "P" flag
18F1    00270           JR      BACK
78      00280   DONE    LD      A,B         ;Store the flags
32xxxx  00290           LD      (FLAGS),A
C9      00300           RET
```

Program Listing 7

```
3Axxxx  10000   DOIT    LD      A,(FLAGS)   ;Get the flags
0F      10010           RRCA                ;Move bit 0 into C
F5      10020           PUSH    AF          ;Save the flags
CDxxxx  10030           CALL    C,INVIS
F1      10040           POP     AF          ;Restore the flags
0F      10050           RRCA                ;Move bit 1 into C
F5      10060           PUSH    AF          ;Save the flags
CDxxxx  10070           CALL    C,SYSTEM
F1      10080           POP     AF          ;Restore flags
0F      10090           RRCA                ;Move bit 2 into C
F5      10100           PUSH    AF          ;Save the flags
CDxxxx  10110           CALL    C,PRINTR
F1      10120           POP     AF          ;Clean off the stack
```

Program Listing 8

A real-estate broker friend asked me to write a data-base management program to file all the properties for sale or rent in his office. I managed to create a system, but was stumped for a time when he wanted cross-referenced printouts of all houses for sale with a den, pool, three bedrooms, and assumable mortgage for under $50,000. All my attempts were too long and slow. Enter the Booleans.

Step one was to assign 2 bytes to store this information; using 1 bit at a time, I could define 16 attributes. The bit assignment worked this way: If the house had a fenced back yard, bit zero was set; if it had a pool, bit 1 was set; if it had a two-car garage, bit 2 was set, and so on. As each house was logged into the system, all that information was stored in shorthand in 2 bytes.

"Eventually, I learned how to use the Boolean logical operators."

When my friend wanted his listing, he answered a series of questions establishing the type of house he was looking for. The questions set the bits in the DE register pair according to the assignments I had made; when he was finished, the program ran the routine in Program Listing 9.

The "AND E" instruction in line 120 compares the byte in A, bit by bit, with the byte in E; if both bits are on, that bit in A is left on, but if either is off, that bit in A will be left off.

A to start with:	0101	1101
E to start with:	1101	1111
A after "AND E":	0101	1101

When the "AND E" is completed, A shows which bits match—which house attributes match the requested attributes. Next, that byte is compared to the original requested attributes in B, and if they match, you continue on to the second set; if not, you bail out and check the next house in the data base.

This method of checking attributes establishes a minimum; the house may very well have other attributes not requested, but at least it has all those requested. If an exact match is required in your application, try Program Listing 10. In this example, "XOR E" com-

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pares A bit by bit with E, and each bit in A is turned on if it is on in either A or E to begin with, but not both. Thus if A and E are an exact match, the result should be zero:

A to start with:	0101	1101
E to start with:	0101	1101
A after "XOR E":	0000	0000

If A and E were not an exact match, the following would occur:

A to start with:	0101	1101
E to start with:	1101	1101
A after "XOR E":	1000	0000

The "OR A" instruction compares A with itself, bit by bit; if any bit in A is on, it remains on after the instruction is completed. If no bits are on, the instruction sets the Z flag. In the last example, the byte in A would fail the test for zero, and the program would branch to the NOPE code. Thus, the program prints out house listings only if the attributes match those requested exactly.

```
3Axxxx  00100  CHECK  LD    A,(BYTE1)  ;Get House Byte 1
47      00110         LD    B,A        ;Store for now
A3      00120         AND   E          ;Compare to request
B8      00130         CP    B          ;Match?
200B    00140         JR    NZ,NOPE    ;...go if not
3Axxxx  00150         LD    A,(BYTE2)  ;Get House Byte 2
47      00160         LD    B,A        ;Store for now
A2      00170         AND   D          ;Compare to request
B8      00180         CP    B          ;Match?
2003    00190         JR    NZ,NOPE    ;...go if not
CDxxxx  00200         CALL  PRNTIT     ;Print it out!
CDxxxx  00210  NOPE   CALL  NEXT1      ;Set up next House
18E8    00220         JR    CHECK      ;...and check it
```

Program Listing 9

```
3Axxxx  00100  EXACT  LD    A,(BYTE1)  ;Get House Byte 1
AB      00110         XOR   E          ;Compare to request
B7      00120         OR    A          ;Is it zero?
2003    00130         JR    NZ,NOPE    ;...go if not
CDxxxx  00140         CALL  PRNTIT     ;Else print it out
CDxxxx  00150  NOPE   CALL  NEXT1      ;Get next House
18F1    00160         JR    EXACT      ;and check it out
```

Program Listing 10

The Teaser

In the next article, I'll tackle the stack and share a few tricks I've learned. To whet your appetite: If your program has not reassigned the stack, and has not abused it (i.e., no values are left at the end, nor have you POPed too many off), you don't have to write JP 402DH as your last command. Before DOS passed control to your program, the address 402DH was placed on the stack; thus, RET will accomplish the same thing and save 2 bytes in the process. ■

Robert Bowker is a free-lance television director. He can be reached at 11360 Sunset Blvd., Los Angeles, CA 90049.

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Input 100 records	50:29 min.	1:27:50 hrs.
Sort & Print Labels	6:41 min.	4:18 min.
Totals	1:02:30 hrs.	13:50:08 hrs.

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The Postman's Second Ring

by Jim Heid

The second version of Soft Sector Marketing's Postman mailing list helps you make your appointed rounds with even greater efficiency.

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Alger Software
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Two disk drives
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Postman has some impressive features (see Table 1). It comprises ten machine-language programs, one sample data file, an 87-page manual, and a padded three-ring binder.

The Postman Software

Two Postman program disks come with the package. One is a single-density disk for the Model I; the other is a double-density disk for the Model III. You must copy the programs in both versions to a system disk. The Model III disk contains a Do file that does the copying automatically.

Postman advertisements recommend DOSPLUS or LDOS, but the program is also compatible with most other TRS-80 disk operating systems. For Model I users, this list includes TRSDOS 2.3, NEWDOS80 Version 2.0, VTOS 3.0 and 4.0, LDOS 5.0.3, and DOSPLUS 3.3D and 3.4D.

For Model III users, TRSDOS 1.3, LDOS 5.1, DOSPLUS 3.4D and 4.0,

Field Information

Nine fields per record, names and lengths as follows:
- Code: 10
- Last Name: 15
- First Name: 15
- Company: 26
- Address: 26
- City: 15
- State: 5
- Zip: 9
- Data 1: 2
- Data 2: 5

Field names and lengths cannot be changed by the user.

Sorting

Machine-language heap sort, one to ten keys
Sort time, approximately .021 seconds per name

Data File Specifications

Maximum size limited only by free disk space
Data Guard feature reconstructs mail list after a system crash
User can transfer data between disks
Hard-disk version available

Label Printing

Capable of printing up to six labels across
Multiple search criteria allowed
Two user-defined messages can be printed on each label
Label size is user definable

Form Letter Generation

Capable of printing up to 255 letters per record
Printing parameters are user definable
Multiple search criteria allowed

Table 1. Postman Specifications

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- COMPUTRONICS: "Here's a program capable of outstanding performance in the preparation of any type of data base...without any previous computer software experience being required of the user. I recommend it without qualification."
- 80-US JOURNAL: "The manual uses a learn-by-doing approach and is so effective that on the first try a complete and highly functional data base was set up. Reports and customized printouts can be generated in minutes."
- COMPUSERVE: "What most distinguishes Data-Writer is that files can be created and maintained with an ordinary word processing program...The 80-page instruction manual is very well done and the whole system is easy to use."

Data-Writer IS useful! Users around the world have discovered the power and flexibility of this extraordinary data base manager that works by itself or with a word processor. Data-Writer is used by managers in large corporations (Bechtel, Honeywell, Owens-Corning, Westinghouse, among others), by small manufacturers, doctors, lawyers, insurance agents, stockbrokers, universities, government agencies, police departments, churches, flower societies, stamp collectors, wine enthusiasts, software retailers, and many more.

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If you have form letters to send to a large group or a subset, if you maintain mailing lists, bibliographies, or inventories with reorder levels, if you want to report accounts payable or receivable, expenses, orders, or any other list of numbers with totals and subtotals, then you will find Data-Writer invaluable. You can even create a subset of a larger list (say, all estate-bottled red wines produced in Napa Valley, St. Emilion and Barossa Valley in 1978, priced between $8 and $12, sorted in order of decreasing price). The possibilities are endless.

For the TRS-80 Models I, III (48K, 2 drives, lower case required). Data-Writer is available from software dealers or direct from Software Options, Inc., 19 Rector Street, New York, NY 10006, (212)785-8285. Toll-free order line: (800)221-1624. Price $145 (plus $3 shipping and handling). NY State residents add sales tax. Visa/Mastercard accepted.

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and NEWDOS80 Version 2 are all compatible. I tested the system using LDOS 5.1.2 on the Model I and III, and found the one minor incompatibility described below.

Using Postman

After you copy the Postman programs to a system disk, you use the system by typing POSTMAN at the DOS Ready prompt. You can protect any routines in high memory by typing POSTMAN (MEM = X), where X is the highest memory location that you want Postman to use. Postman honors the DOS HIGH$ memory pointer, so if your high-memory routines set it, you do not need to specify a memory size.

When Postman executes, a title and copyright notice appear for a few seconds. Then the main menu slides in from the right side of the screen (see Fig. 1). This programming gimmick is interesting the first couple of times you use the system, but I tired of waiting for the menu to make its three-point landing every time I wanted to use a different Postman program.

Fortunately, pressing any key while Postman is loading overrides the menu's dramatic appearance and brings it to the screen immediately.

Your first step is to initialize a Postman data disk. To do this you select option six, "New Data Disk File Preparation," from the main menu. Postman asks you which drive contains a formatted data disk. The program does not let you select a nonexistent drive number.

Here I found Postman's only incompatibility with LDOS. If I enter an illegal drive number, the screen displays garbage for a few seconds before prompting me again. Apparently Postman cannot pick up the Illegal Drive Number error code from LDOS. While this bug does not cause the program to crash, it is an annoyance.

After you enter an appropriate drive number, Postman asks how many addresses you want to hold on the data disk. Most users will simply press the enter key, telling Postman to use all the free disk space. Postman then asks for a disk name, limited to 32 characters.

Finally, the disk is initialized and Postman indicates the maximum num-

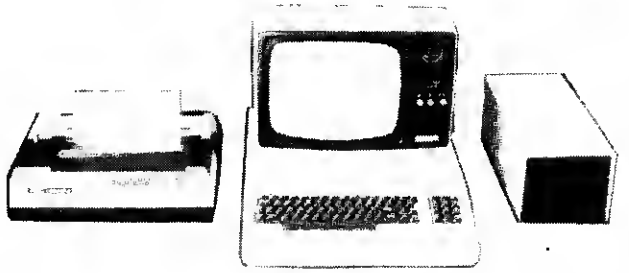
```
The POSTMAN Mass Mailing System        Ver 2.29
.............................          Alger Software

    Please select the function you wish to use.

.Selection.......   Function
   Key              Description
.....................................................................
    1  . . . . POSTEDIT Label Data Manipulation
    2  . . . . POSTLIST Label Data Columnar Listing
    3  . . . . POSTRITE Form Letter Generation
    4  . . . . PSTFILES Allow Operator to Change Diskettes
    5  . . . . PSTMERGE Move/Merge Labels to New Data Disk
    6  . . . . POSTPREP New Data Disk File Preparation
    @  . . . . Return control to the disk operating system
           Enter selection -->
```

Fig. 1. Postman Main Menu

LNW80 COMPUTERS



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MODEMS	55	25-pin RS232 MALE PLUG to 25-pin RS232 MALE PLUG	15.50	17.00	18.50	20.00	21.50
MODEMS	56	25-pin RS232 FEMALE PLUG to 25-pin RS232 FEMALE PLUG	15.50	17.00	18.50	20.00	21.50
MODEMS	57	25-pin RS232 MALE PLUG to 25-pin RS232 FEMALE PLUG	15.50	17.00	18.50	20.00	21.50
INTERCONNECT	61	34-pin CARD-EDGE CONNECTOR to 34-pin CARD-EDGE CONNECTOR	13.50	15.00	16.50	18.00	19.50
INTERCONNECT	62	34-pin DUAL-ROW-PLUG to 34-pin DUAL-ROW-PLUG	14.50	16.00	17.50	19.00	20.50
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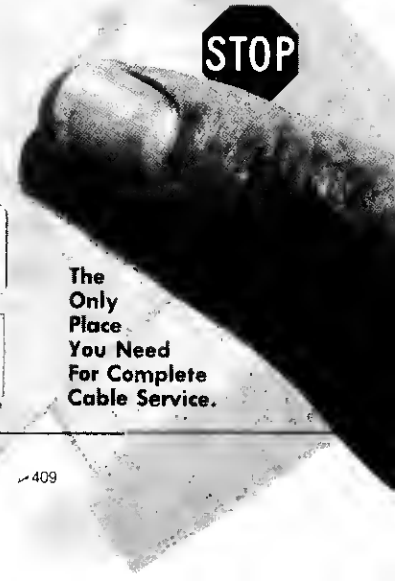

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ber of addresses allowed. A 40-track, single-density, LDOS-formatted data disk holds 742 records, and a 40-track, double-density disk also formatted under LDOS holds 1,348 records.

After readying a data disk, the program asks if you want to prepare another one. If you have more than two disk drives you might want to because a Postman data file artificially links disks. Postman searches all the drives in your system and connects their mail-list files together, forming what looks like one massive, continuous file. This feature makes Postman a natural for users with an especially large mailing list.

The data disk preparation program contains full error checking, and the program gives you several opportunities to abort the initialization process if, for example, you find that you've inserted the wrong data disk.

After you prepare as many data disks as you need, Postman's main menu slides in again from stage right. You begin entering names and addresses by selecting option one, "Address Data Manipulation."

The program then displays "LOADING Postedit" in the middle of the screen, an area used throughout Postman for error and status reporting. Every time a program loads, a boxed message appears. Any operator or system errors also appear there. Display formats are consistent and attractive.

Entering Data

The Postedit program is the workhorse of Postman. Using this program, you add, change, delete, print, search for, and view your mailing-list entries. The Postedit screen is shown in Fig. 2.

The top of the screen tells you how many records you have used and how many empty records remain. The center of the screen contains the fields that comprise one record. Each period represents a possible character, and the parenthesis at the end of each field denotes its length. The bottom of the screen contains Postedit's menu.

To add a new record to your list, choose the "Insert new label" option by pressing the I key. The periods disappear, a flashing block cursor appears at the first position of the Code field, and a summary of screen editor commands appears at the bottom of the screen (see Fig. 3).

The arrow keys move the cursor within the fields; pressing enter tabs to the beginning of the next field. The remaining screen editor functions are delete character (shifted left-arrow key), delete to end of field (clear key or shifted clear key for LDOS/VTOS users), insert character (shifted right-arrow key), and apply the overlay contents (described below).

The screen editor is easy to use. The keyboard is fully debounced and keeps up with the fastest typists. You can also print the current record in label format by typing shift, down arrow (control), and the letter O.

The overlay is a time-saving feature. If you have a number of addresses that share common data—city, state, and zip code, for example—you can put the common data into an overlay. The contents of the overlay are then applied to every record by hitting two keys (control-V).

The Postedit menu contains an option to change the overlay. When you select it, a screen similar to the one in Fig. 3 appears, except that each field contains small graphics blocks to remind you that you are not entering label data.

After you type a complete record, there are two ways to exit the screen editor. Pressing the at key (@) stores the record on disk and clears the fields for another record. You use this method when entering more than one address record.

You use the other method when you are finished entering your list. Pressing shift and the at key brings a small menu to the bottom of the screen. From this menu you can write the current record and return to the Postedit menu, apply the overlay to the record, inspect the current overlay, or forget the current label and exit to the menu.

The overlay inspection option is interesting; when you hold down the I key, it displays the current contents of the overlay in the existing field positions. When you release the key, whatever was previously in each field pops back on the screen.

Some Postedit Options

You can select another of the options on the Postedit menu, "Edit current label," by pressing the E key. The cursor appears in the first position of the first field and the screen editor menu appears at the bottom of the screen.

At this point you can edit the record contents. The screen editor's functions

```
P O S T M A N  --  2.29
File Usage:        1-Used      1348-Max
.............................................................
   Code(..........)
  Lname(...............)     Fname(...............)
Company(...........................)
Address(...........................)
   City(...............)     State(.....)     Zip(.........)
  Data1(..)    Data2(.....)
.............................................................
.....................  Main Function Menu  ....................
  <- Prior Label     <E>dit Current Label     <L>ocate Label
  -> Next Label      <D>elete Current Label   <F>ast Search
  <- (Shift) ->      <I>nsert New Label       <X> Set Up Printer
  First -- Last      <V> Change Overlay       <O>ne Label Print
 <@> Return to MENU   <S>ort Labels           <P>rint to File End
```

Fig. 2. Postedit Screen

```
P O S T M A N  --  2.29
File Usage:        2-Used      1348-Max
.............................................................
   Code(sales.....)
  Lname(H..............)     Fname(...............)
Company(...........................)
Address(...........................)
   City(Peterborough...)     State(NH...)     Zip(Ø3458....)
  Data1(..)    Data2(.....)
.............................................................
.................  Screen Editing Controls  ..................
  Move Cursor          Field Edit                Exit Editor
      [        (Shift) ->  Insert Blanks        (@) Auto Upd/Ins
    <-   ->    (Shift) <-  Delete Chars
      \        (Clear)     Clear to Field End    (Shift @) Exit
               (Enter)     Tab to Next Field
```

Fig. 3. "Insert New Label" Option

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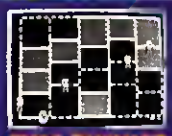

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and commands are identical to those described above. This design consistency throughout Postman makes the system easy to learn and use.

You delete a record currently on the screen using the "Delete current label" option. When you press D, the bottom of the screen displays a message asking, "Do you REALLY want to delete this label?" Pressing Y deletes the label; pressing any other key returns you to the Postedit menu.

A minor bug surfaces here. If a label is not displayed on the screen and you press D, the message "CANNOT do that until a label is on the" appears. The word "screen" is left out of the message.

Searching: Quick, Fast, or Selective?

Three other Postedit options let you search for a particular label. Two of the options are called "fast search" and "quick search." The third, called the selective search, is described below.

All three options operate similarly: type in the information you want to look for, called search criteria, and the program looks through your mailing list and displays the records that contain matching information. The primary differences between the options are the amount of information you can search for and the search speed.

The quick search is the fastest of the three. It lets you jump to an approximate location in your mailing list and searches only the primary sort field of each record.

If you want to search for the last name Heid, for example, your list would first have to be sorted by last name. You would then enter the name HEID (or a portion of it) and the quick search positions the mailing-list file to the first record that begins with the letters HEID in the last-name field.

If your list does not contain any last names that begin with HEID, the quick search positions the file to the location where HEID would be if it existed (between HARRIS and HONUS, for example). Quick search is a convenient way to get in the ballpark.

Use the fast search when you want to search a field other than the primary sort field. It also has several options. To begin, type what you're looking for, called the search key, and press enter. Unlike the quick search, you must type the entire search key. (If you want to look for the name HEID, you have to type the full name; typing only HE won't work.)

The program then searches your list for a record with a matching field. If it finds one, it displays the record above a small menu. This menu lets you continue the search, print the record that was just found, enter a new search key, or return to the Postedit menu. If a matching record is not found, the program tells you and returns to the Postedit menu.

The third method, called the selective search, allows multiple search criteria. When you select it, a screen called the search mask appears. The search mask looks like the normal screen-editor display, except that each field contains a small white square in each character position. Like the overlay mask, this reminds you that you are not entering new records.

Before you can perform a selective search, you have to tell the search mask what you are looking for. This is done by typing each criterion into the mask as if you were typing a normal record.

Assume you want to search for the address of every person who lives in Peterborough, NH, whose last name starts with H, and whose Code field starts with the word "sales." You must first edit the search mask until it looks like Fig. 4, then you conduct the search.

When the program finds a matching record, it appears with a small menu below it. The menu lets you continue the search, print the record just found, enter new search criteria, or return to the main menu.

If no matching record is found, the program displays a message and gives you the opportunity to conduct the search again, to change or clear the search mask, or to return to the main menu.

The selective search has two interesting and valuable features. First, it compares only the characters you enter in the search mask to the characters in the corresponding fields. If you want to search for every record with a zip code field beginning with the digits 152, you enter only those numbers in the search mask's zip code field. Similarly, a search mask with the letters JO in the first-name field selects records with first-name fields containing JOHN, JOANNE, and JONATHAN.

Second, you can enter search criteria using upper- or lowercase letters; Postman considers them identical when searching.

```
P O S T M A N  --  2.29
File Usage:        1-Used      1348-Max
.............................................................
   Code(45-A       )
  Lname(Doe            )     Fname(John            )
Company(John Doe Co.              )
Address(123 Main Street           )
   City(Notown          )     State(NH    )     Zip(Ø34ØØ     )
  Data1(1A)    Data2(sales)
.............................................................
.................  Screen Editing Controls  ..................
  Move Cursor          Field Edit                Exit Editor
      [        (Shift) ->  Insert Blanks        (@) Auto Upd/Ins
    <-   ->    (Shift) <-  Delete Chars
      \        (Clear)     Clear to Field End    (Shift @) Exit
               (Enter)     Tab to Next Field
```

Fig. 4. Edited Search Mask

Printing Data

Postman prints mailing labels three ways: for a single record, for all the records, or for only those records that match certain criteria. The last method uses the search mask described above.

Using the printer setup menu, you can change the default values for the width and number of lines of each label, the width of your paper in number of labels, and the number of labels to print for each record.

You can also tell Postman what fields to print, where to print them, and whether to print your records in all uppercase letters or upper- and lowercase letters. Postman lets you print two comment lines on each label.

The label-printing portion of Postman is easy to use and error-free. Printer setup and label design are cumbersome in some mailing-list systems, but Postman's menus make the entire label-printing job simple, even for inexperienced computer operators.

You can print your name-and-address data in what Postman's manual calls a columnar data listing. This is a printout of the contents of each record.

You can change the default values for page length and margins, and specify which fields to print. You can also send hexadecimal codes to your printer to select any special print styles that it

might have.

Reliability

Postman has a trademarked feature called Data Guard. If your computer resets, crashes, or loses power while writing to a data disk, Postman automatically invokes a "reconstruction module" that rebuilds the mail-list index the next time you use it.

I tested this feature by entering 36 sample records and shutting off my computer during the disk write of the last record. When I restarted the system, the screen displayed a message saying that the program had invoked the reconstruction module. It gave me an opportunity to enter a new disk label in case the old one was scrambled, which it was.

The screen then displayed the message, "Index reconstruction in progress." A graphics display moved around the bottom of the screen to let me know that the computer was busy, and after a few minutes of disk activity, my mailing list was again complete.

Using Postwriter

Postwriter takes an existing file containing special "insert flags" and prints it, combining data from your mailing list with the contents of the file. Basic or any word processor that saves in ASCII format can create the file.

The purchase of Postwriter is optional (Postman costs $125 without it), but I recommend it. If your mailing list application involves any type of form letter, you'll find it indispensable and as easy to learn and use as the rest of the Postman system.

Postwriter prints up to 255 copies for each record, right-justified or ragged right, on single sheets or continuous-feed paper. You can also specify other printing parameters, including page width, left margin, line length, page length, number of printed lines per page, and line spacing. Your letters can include two messages, each up to 63 characters long.

Postwriter's best feature is its ability to print letters for selected records. You can do this by filling out a select mask in the same way as the selective search, then instructing Postman to print letters for only those records.

The Postwriter search mask has an additional feature. If you enter a question mark in a given character position within a field, Postwriter doesn't compare that character position when searching. Entering H??D, for example, causes a match with HEID, HADD, and HERD. The question

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mark is called a wild-card character and it gives you even more flexibility when printing form letters.

You can divide one of the code fields so that each character position stands for a category. By assigning each letter a specific meaning, you could code a massive amount of information into each character position. Using the wild-card feature, you can then print letters for records that match certain categories.

Although Postwriter was not written by the same programmer who wrote the rest of the Postman system, its screen displays and menus look nearly identical. Its one annoyance is that the program only responds to uppercase letters in its menu selections. If you are typing in upper- and lowercase, you must hold down a shift key when making your selections.

The rest of the Postman system accepts either upper- or lowercase menu selections. Aside from this quirk, Postwriter is easy to use, error-free, and a natural extension of the Postman system.

Pigeon Holes Are for the Birds

Almost every software package has a flaw, and Postman's is its manual. It is poorly written, containing lines like, "What FORMAT does is to fill the new diskette with little 'pigeon holes.' " (I kept wanting to feed them.)

The manual is also poorly organized. It goes off on tangents to explain concepts that should be introduced later, forcing the reader to perform mental GOSUBs and Returns in an attempt to follow the discussion.

Worst of all, the manual is incomplete. One of Postman's best features, the ability to apply a predefined overlay to every name-and-address record, is not even mentioned. Only by seeing the overlay options on the system's menus did I realize the feature existed.

To help you prepare a new data disk, the manual refers you to a chart in the back that indicates how many addresses fit on each disk. That chart doesn't exist.

Finally, the manual is unattractive and hard to read. Daisy-wheel printers are fine for letters, but not for documenting business software. The manual should have been typeset for greater legibility.

Is Postman for You?

Yes, if your application requires extensive searching capabilities, fast sorts, flexible print options, and mass storage. Postman's ability to span disk drives and create what looks like one coherent file makes it ideal for owners of more than two disk drives. And for owners of hard disk drives, a special $225 version of Postman puts you into the mailing-list management business.

Postman is not for you if your application requires saving a lot of other data along with each name and address. Postman's code fields hold only 17 characters combined. If you want to store additional information with each name and address, you should consider either a mailing list that allows more code fields or a data-base manager.

Postman is capable of maintaining and manipulating large mailing lists easily, quickly, and reliably. It requires little technical knowledge to use, and although it's poorly documented, the system is designed so well that learning it is simple.

The optional Postwriter program almost makes printing form letters fun and is a perfect companion to Postman. The Postman system is a quality software product. ■

Jim Heid is a technical editor for Wayne Green Books Inc. He can be reached c/o 80 Micro.

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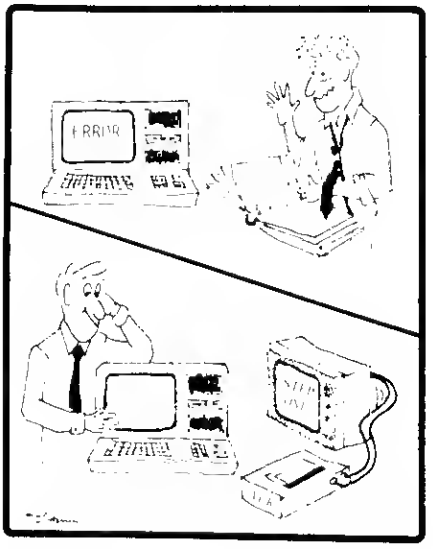

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Letter-Frequency Distribution—Cryptology, Part IV

by Karl Andreassen

Here's another article in the cryptology series. You'll learn how to use letter-frequency distributions to crack ciphertext.

Cryptanalysis is the art and science of finding plain language hidden in ciphers. In this article, the fourth in a continuing series (see the Anniversary, February and April issues of *80 Micro*), I will address letter-frequency distribution patterns in ciphertext and provide a Model II program to help identify this pattern.

An analysis of common English text reveals a consistent, letter-frequency pattern known as the normal distribution of letters. The frequency with which letters appear in text is given below, listed in descending order:

ETAONIRSHDLUCMPFYWGBVJKQXZ

Language in scholarly journals has a slightly different pattern, although the first few letters remain at the high-frequency end of the list. Professional specialty languages such as those used by attorneys, physicians, politicians and the military have distinctive letter-frequency distribution patterns.

An experienced cryptanalyst usually recognizes such patterns just as dialect experts pinpoint a person's geographical origin by listening closely to his speech inflections and words.

Figure 1 lists seven distributions from various texts. The last four lines demonstrate one use of the sampling feature included in the Program Listing, which lets you examine short portions of a longer ciphertext.

When you break down a single-stage substitution cipher to its letter frequencies and find it to be similar to the normal frequency pattern, you are ready to try a few letter substitutions. The pro-

From 100-letter samples from plaintexts:

E R A N T O S I P H M C D U F Y L W G V
E T A O N I H D R W G S C U L P F B Y K M V
E T H A S D N I L O R M G Y C F P K X B U V

From a 1024-letter sample of plaintext:

E T O A I R S N H C D U G M F L V W P B Y K J X Z

A 500-letter sample extracted from the above 1024:

E T A O N H I R S C U G F M V L D B W P K Z

100-letter samples from the 1024-letter plaintext:

E O R A T H D S P I G M N U B W C L F K
E I S A T N R O D U C Y M H F P B L W G K

Fig. 1. Letter Distributions from Plaintexts

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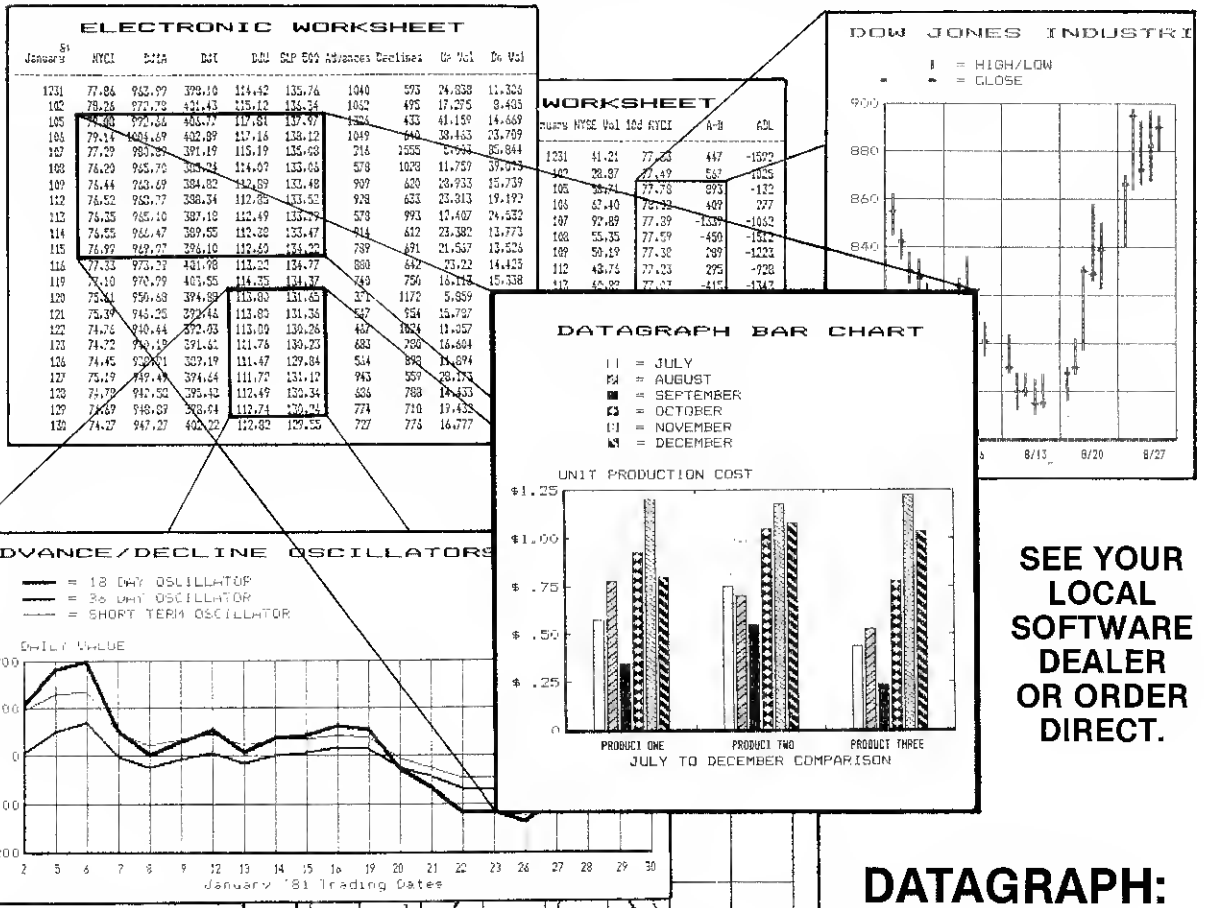

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gram in "The Art of Encoding and Decoding" (*80 Micro*, February 1983, p. 244) helps you solve ciphers.

This month's program reduces the labor of counting letter frequencies and displays the letter-frequency spread of an unknown ciphertext in both graphics and tabular form, on-screen and with hardcopy option. You are likely to refer to a particular ciphertext more than once, so the program saves the text on disk.

I enciphered a line of plaintext from a local newspaper using the program in "The Art of Encoding and Decoding." I then entered the resulting ciphertext into the Program Listing in this article. The graph of Fig. 2 shows a characteristic profile for simple substitution ciphers. Letter-distribution profiles of various ciphertexts carry distinctive patterns, each becoming almost as familiar to a cryptanalyst as facial features of friends and relatives.

You may find the percentages listed in Table 1 helpful in working back from ciphertext to plain language (plaintext). You can learn more about the significance of this table and accompanying graphs in such notable books as Kahn's *The Codebreakers* (Macmillan, 1967).

You can enter plaintext from many sources into this program to study text profiles and letter percentages and to familiarize yourself with known text patterns. If you first enter plaintext and then substitute ciphertext for that plaintext and compare hard-copy profile graphs, you will find them very close, even though the letter columns have changed. The descending-order graphs are identical.

This immediately shows you how the meaning of the language is preserved even though the spelling has undergone considerable crypto manipulation and, further, why substitution ciphers are relatively easy to crack.

As you become familiar with substitution ciphers, enter more complex ciphertext into the program to broaden your expertise. When you find a ciphertext that reveals an essentially flat letter-frequency profile, you have come across a deceptive random hash of letters, or a very tight cipher system.

If you enter a known random sample of more than 500 letters into the Program Listing and inspect the profile graph, the flatness of the profile reveals how close to true random your letters come. The larger the sample, the more nearly flat the profile.

The more letters you enter (up to the 1024 maximum), the taller your distribution graph. Text over 250 words causes the graph to scroll on the screen.

Program Listing

```
10 CLS :CLEAR 5000 :Z=160
20 DIM A$(1030), B$(30),B(30),C$(1030)
30 PRINT :PRINT :PRINT :PRINT :PRINTTAB(20) "CRYPTANALYST'S AIDE NO.2"
40 PRINTTAB(23) "by Karl Andreassen
50 PRINTTAB(21) "Copyright January 1983
60 FOR X=1 TO 1000 :NEXT X
70 PRINT :PRINTTAB(5) "Crypto Aide No.2 affords three functions:"
80 PRINT :PRINTTAB(30) "< A >"
90 PRINTTAB(5)"From file or keyboard, prepares an x-y graph of repetitions in
100 PRINTTAB(5) "alphabetical order, with option to screen or print the graph."
110 PRINT :PRINTTAB(30) "< B >"
120 PRINTTAB(5)"From file or keyboard, tallies and presents graphically cipher-
130 PRINTTAB(5) "text letter repetitions in descending order, plus optional
140 PRINTTAB(5)"table of letter percentages relative to total in text."
150 IF E=1 THEN PRINT "SELECT <A> OR <B> "; :LINEINPUT A0$
160 IF E=1 THEN 700
170 PRINT :PRINTTAB(30) "< C >"
```

Listing continues

Letter	Frequency	Percent
T	15	11.9048
E	14	11.1111
O	11	8.73016
R	11	8.73016
N	10	7.93651
A	9	7.14286
S	7	5.55556
I	7	5.55556
P	5	3.96825
F	5	3.96825
M	5	3.96825
L	4	3.1746
C	4	3.1746
Y	3	2.38095
U	3	2.38095
G	2	1.5873
H	2	1.5873
D	2	1.5873
W	2	1.5873
X	2	1.5873
B	1	.793651
K	1	.793651
Q	0	0
V	0	0
Z	0	0

Table 1. Descending Order Letter Count with Percentages

Listing continued

```
180 PRINTTAB(5) "Files ciphertext as entered from keyboard, for multiple
190 PRINTTAB(5) "or subsequent passes during analysis."
200 PRINT :PRINTTAB(11) "SELECT A, B, OR C:   "; :LINEINPUT A0$
210 IF A0$<>"A" AND A0$<>"B" AND A0$<>"C" THEN 70 '<=Error detector
220 IF E=1 THEN 700'==Toggle
230 IF A0$="C" THEN A1$="FILE" :GOTO 300
240 CLS :PRINT :PRINT "ENTER CIPHERTEXT FROM KEYBOARD < KEYB > "
250 PRINT ".....READ CIPHERTEXT FROM FILE < READ >"
260 LINEINPUT ".........ENTER ONE OF THE ABOVE: ";A1$
270 IF A1$="KEYB" THEN 490
280 IF A1$="READ" THEN 300
290 IF A1$<>"KEYB" AND A1$<>"READ" AND A1$<>"FILE" THEN 240
300 PRINT :LINE INPUT "ENTER FILE NAME: ";CC$
310 IF A1$="READ" THEN 330
320 IF A1$="FILE" THEN 440
330 OPEN "D", 1, CC$, 1
340 FIELD 1, 1 AS BB$
350 PRINT "Total number of characters in file = "LOF(1)
360 INPUT "ENTER DESIRED BEGINNING NUMBER OF CHARACTER COUNT, 1 TO 1023 ";A
370 INPUT "ENTER DESIRED ENDING NUMBER OF CHARACTER COUNT, 2 TO 1024 ";B
380 CLS :I%=A :IF A=0 THEN I%=1 :A=1  '==Set READ parameters
390 GET 1, I%
391 PRINT I%;
400 A$(I%)=BB$ '==Load array with file contents
410 IF I%=LOF(1) OR I%=B THEN 430
420 I%=I%+1 :GOTO 390
430 CLOSE :E=1
440 FOR X=1 TO 26
450 B$=B$+CHR$((X)+64) '==Make ref alphabet
460 B$(X)=CHR$((X)+64) '==Make alphabet array
470 NEXT X
480 IF A1$="READ" THEN GOTO 700
490 CLS :PRINTTAB(10) "ENTER THE CIPHER UNDER STUDY EXACTLY AS RECEIVED."
500 PRINTTAB(10) "SPACE BAR OK, BUT NO PUNCTUATION PERMITTED.":PRINT
510 PRINT :PRINT "IF ENTRY COMPLETE BEFORE 1024 CHARACTERS, TOUCH < * >."
520 PRINT :PRINT
530 I%=I%+1
540 IF I%>1024 THEN 620
550 Z$=INKEY$ :IF Z$="" THEN 550
560 IF ASC(Z$)=32 THEN PRINT " "; :GOTO 550
570 IF ASC(Z$)=13 THEN PRINT CHR$(13) :GOTO 550
580 IF Z$="*" THEN 620
590 A$(I%)=Z$
600 PRINT Z$;
610 GOTO 530
620 IF A1$="FILE" THEN 630ELSE 700
630 OPEN "D", 1, CC$, 1 '==File ciphertext sequence
640 FIELD 1, 1 AS BB$
650 FOR X=1 TO I%
660 LSET BB$=A$(X)
670 PUT 1 :NEXT X
680 CLOSE :A1$="" :E=1
690 CLS :PRINT:PRINT "CIPHERTEXT FILED.  PROCEED WITH A OR B:" :GOTO 80
700 FOR X=1 TO 26
710 A$=A$+CHR$(X+64) '==Reference alphabets
720 B$(X)=CHR$(X+64)
730 NEXT X
740 PRINT :PRINT :PRINT "COUNTING LETTER REPETITIONS IN CIPHERTEXT..."
750 PRINT "WAIT PERIOD ENTRY DEPENDENT, 5 TO 60 SECONDS."
755 SYSTEM "CLOCK" :PRINT@146, TIME$
760 CLS :PRINT :PRINT :FOR X=1 TO I% :PRINT A$(X); :NEXT X
768 IF A1$<>"READ" THEN A=1
769 FOR X=A TO I%
770 FOR Y=1 TO 26 '== Count letter repetitions
780 IF A$(X)=MID$(A$,Y,1) THEN B(Y)=B(Y)+1
790 IF B(Y)=>L THEN L=B(Y)+1 '==Set graph vertical parameter
800 NEXT Y
805 PRINT@Z,"."; :Z=Z+1
806 PRINT X;
810 NEXT X
815 PRINT@226,TIME$ :SYSTEM "CLOCK OFF"
820 IF A0$="A" THEN 1110
830 IF A0$="B" THEN 850
840 IF G=1 THEN PRINT "SORT PREVIOUSLY DONE." :GOTO980
850 PRINT "Sort proceeding in descending order of letter frequency. "
860 PRINT "Sort requires 5 to 15 seconds, dependent upon quantity entered. "
870 FOR X=1 TO 25 '==Begin sort sequence
880 FOR Y=1 TO 25
890 IF B(Y)>B(Y+1) THEN GOTO 960
900 T=B(Y)
910 E$=B$(Y)
920 B(Y)=B(Y+1)
930 B$(Y)=B$(Y+1)
940 B(Y+1)=T
950 B$(Y+1)=E$
960 NEXT Y
970 NEXT X :G=1 '==End sort sequence
980 CLS :PRINT "RANKING BY REPETITION:"
990 CLS :PRINTTAB(20)"LETTER FREQUENCY TABLE" :PRINT
1000 PRINT"FREQ";TAB(8)"%";TAB(15)"FREQ"; TAB(24)"%";TAB(30)"FREQ";TAB(38)"%";
1010 PRINTTAB(45)"FREQ";TAB(53)"%"; TAB(60)"FREQ";TAB(68)"%"
1020 FOR X=1 TO 5 '==Lay in letter frequency % table
1030 PRINT B$(X);B(X);B(X)/I%*100;
1040 PRINTTAB(15)B$(X+5);B(X+5);B(X+5)/I%*100;
1050 PRINTTAB(30)B$(X+10);B(X+10);B(X+10)/I%*100;
1060 PRINTTAB(45)B$(X+15);B(X+15);B(X+15)/I%*100;
1070 PRINTTAB(60)B$(X+20);B(X+20);B(X+20)/I%*100
1080 NEXT X
1090 PRINT :INPUT "HARDCOPY THIS TABLE < Y/N >";A4$
1100 IF A4$="Y" THEN 1400ELSE 1110
1110 CLS :FOR X=1 TO I% :PRINT A$(X); :NEXT X :PRINT
1120 FOR X=L TO 1 STEP -1 '==Print graph to screen
1130 FOR Y=1 TO 26
1140 IF B(Y)=>X THEN PRINTTAB(10) CHR$(154)" "; ELSE PRINTTAB(10) ". ";
1150 NEXT Y
1160 PRINT X
```

Listing continues

clipping off the top. You should make hard copies of these graphs and fold or roll the paper to print the entire graph. Enter the System "FORMS P=0, L=0" call when using letter-sized paper to keep the printer from spacing six lines when the ordinary page length is exceeded.

The Program

The variables used are listed in Table 2.

The menu, lines 70–200, offers three options: an X,Y graph listing letter frequencies of the input text (either plaintext or ciphertext) in alphabetical order; a table of letter-to-total percentages in descending order; followed by an optional graph, also in descending order, of letter frequencies; and an option to file the input text.

If you choose the first option, the resulting profile graph is followed by an option to construct the descending order percentage table and graph. If you choose the second, the descending order table and graph are run without the profile. Both menu selections are followed by a KEYB, READ option, which lets you enter text from either the keyboard or from a previously recorded file.

The INKEY$ function in lines 490–610 accepts keyboard text entry with auto jump to file or count, if the total text runs more that 1024 letters. If it is less, touching the asterisk key diverts the program to the subroutine.

If you choose to work with filed copy, you can select any portion or all of the file. When the A$ array is completed the KEYB-READ selection appears. Counting letters can take from

Continues on p. 196

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Listing continued

```
1170 NEXT X
1180 FOR X=1 TO 26
1190 IF G=1 THEN PRINTTAB(10)B$(X)" "; :GOTO 1210
1200 PRINTTAB(10) MID$(A$,X,1)" ";
1210 NEXT X
1220 PRINT I
1230 INPUT "HARDCOPY PRINTOUT THIS GRAPH <Y/N> ";A5$ :A2$=A5$
1240 IF G=1 AND A5$="N" THEN END
1250 IF A5$="Y" THEN 1510ELSE INPUT "DESCENDING ORDER GRAPH <Y/N> ";A6$
1260 IF A6$="Y" THEN 850ELSE END
1270 FOR X=L TO 1 STEP -1 '==Graph to printer
1280 FOR Y=1 TO 26
1290 IF B(Y)=>X THEN LPRINTTAB(10) "* "; ELSE LPRINTTAB(10) "  ";
1300 NEXT Y
1310 LPRINT X
1320 NEXT X
1330 FOR X=1 TO 26
1340 IF A2$="Y" THEN LPRINTTAB(10) B$(X)" "; :GOTO1360
1350 LPRINTTAB(10) MID$(A$,X,1)" ";
1360 NEXT X
1370 LPRINT
1380 GOTO 1630
1390 END
1400 LPRINT"FREQ";TAB(8)"%";TAB(15)"FREQ"; TAB(24)"%";TAB(30)"FREQ";TAB(38)"%";
1410 LPRINTTAB(45)"FREQ";TAB(53)"%"; TAB(60)"FREQ";TAB(68)"%"
1420 FOR X=1 TO 5 '==Hard copy, letter frequency table
1430 LPRINT B$(X);B(X);B(X)/I%*100;
1440 LPRINTTAB(15)B$(X+5);B(X+5);B(X+5)/I%*100;
1450 LPRINTTAB(30)B$(X+10);B(X+10);B(X+10)/I%*100;
1460 LPRINTTAB(45)B$(X+15);B(X+15);B(X+15)/I%*100;
1470 LPRINTTAB(60)B$(X+20);B(X+20);B(X+20)/I%*100
1480 NEXT X
1490 IF G=0 THEN 850
1500 IF G=1 THEN 1110
1510 FOR X=L TO 1 STEP -1 '==Hard copy graph
1520 FOR Y=1 TO 26 '==Hard copy, profile and descending graphs
1530 IF B(Y)=>X THEN LPRINTTAB(10) "* "; ELSE LPRINTTAB(10) "  ";
1540 NEXT Y
1550 LPRINT X
1560 NEXT X
1570 FOR X=1 TO 26 '==Hard copy graph
1580 IF A2$="Y" THEN LPRINTTAB(10) B$(X)" "; :GOTO1600
1590 LPRINTTAB(10) MID$(A$,X,1)" ";
1600 NEXT X
1610 LPRINT
1620 IF G=1 THEN END
1630 CLS :INPUT "IS DESCENDING ORDER GRAPH DESIRED <Y/N> ";A5$
1640 IF A5$="Y" THEN 850ELSE END
```

Continued from p. 193

five seconds for a few letters to 5¾ minutes for a full 1024-letter text, so a preliminary run with a shorter sample saves time.

The clock readout is turned on during

Variables	Functions
A	Begin file records
B	End file records
E	File toggle
F	Graph toggle
G	Sort toggle
L	Graph limiter
A$	Menu selection
B$	A–Z alphabet string
Z$	Input from keyboard
A0$	Option input
A1$	Option input
A2$	Option input
A4$	Option input
A5$	Option input
A6$	Option input
A$( )	Read ciphertext data
B$( )	A–Z alphabet array
BB$	Data file field variable
CC$	Data file name
I%	File record number

Table 2. Program Variables

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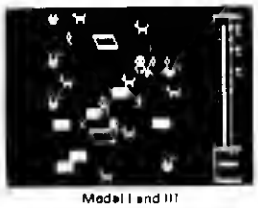

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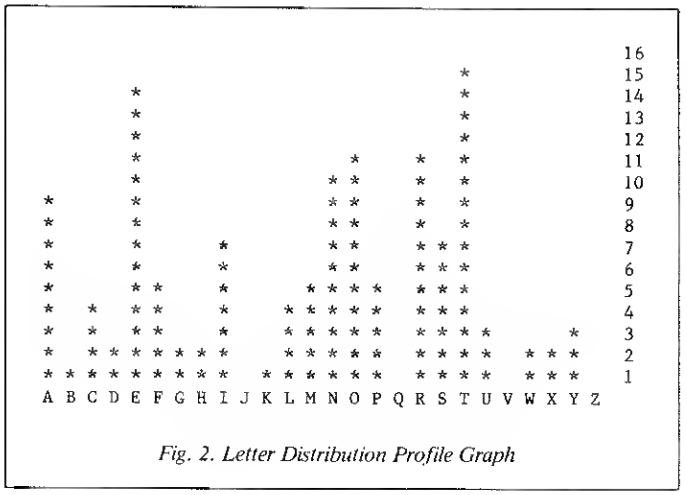

Fig. 2. Letter Distribution Profile Graph

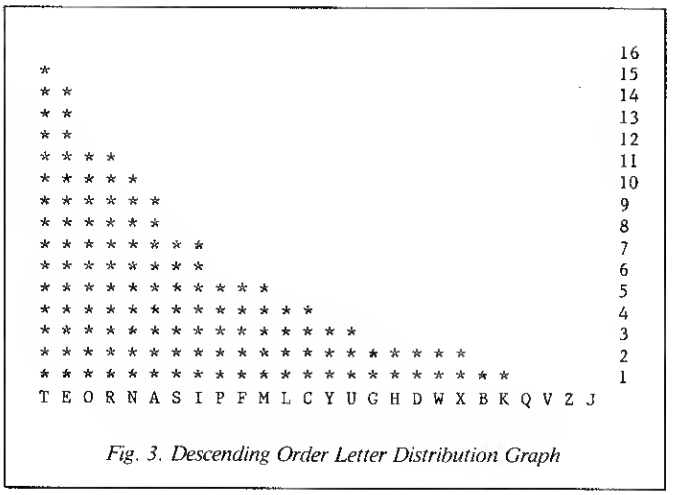

Fig. 3. Descending Order Letter Distribution Graph

the counting period and the starting time is recorded directly below it for comparison. The ending time is indicated momentarily for reference as the count function ends, and the clock is turned off. I included timing to give you some idea of when the count should be finished. The countdown is on the screen to provide visual activity during the wait period.

The sort subroutine of lines 850–970 completes a full text sort in the same time as a short entry—about 15 seconds.

BLF XZM VMGVI KOZRMGVCG UILN NZMB HLFIXVH RMGL GSRH KILTIZN ULI HGFWB LU KILUROVH ZMW OVGGVI KVIXVMGZTVH GL YVXLNV UZNRORZI DRGS PMLDM GVCG KZGGVIMH RU BLF URIHG VMGVI KOZRMGVCG ZMW GSVM GSV HFYHGRGFGRLM XRKSVIGVCG IVHFOGRMT UILN GSZG KOZRMGVCG ZMW XLNKZIV SZIW XLKB KILUROV TIZKSH BLF DROO URMW GSVN EVIB XOLHV VEVM GSLFTS GSV OVGGVI XLOFNMH SZEV XSZMTVW GSV WVHXVMWRMT LIWVI TIZKSH DROO YV RWVMGRXZO GSR

Fig. 4. Ciphertext Sample

The letter-frequency table is sent to the screen by lines 990–1080 and to the printer by lines 1420–1480. The graph goes to the screen by lines 1110–1210 and to the printer by lines 1510–1570.

Tips on Program Use

After using the program as a training aid or a refresher for recognition of ciphertext profiles, enter and save ciphertexts. Even though the tendency is to think you'll need only one run-through (and therefore don't need to save your work), you should save longer texts to reduce the work of running shorter excerpts from the text.

The more text you have to work with, the more likely you'll find a solution early. Short texts can produce misleading profiles, so if more than one message is available in what you believe is the same kind of cipher, enter as many of those short texts as possible.

Use this program in conjunction with that from "The Art of Encoding and Decoding" to form the beginning of your computer-assisted, crypto-lab aids.

Figure 4 is a rather long sample ciphertext; in practice it is better to keep a ciphertext as short as possible, although in cracking an unknown cipher you can thank the wordy originator for the longer sample. ■

Karl Andreassen can be reached at 24750 Chianti Road, Cloverdale, CA 95425.

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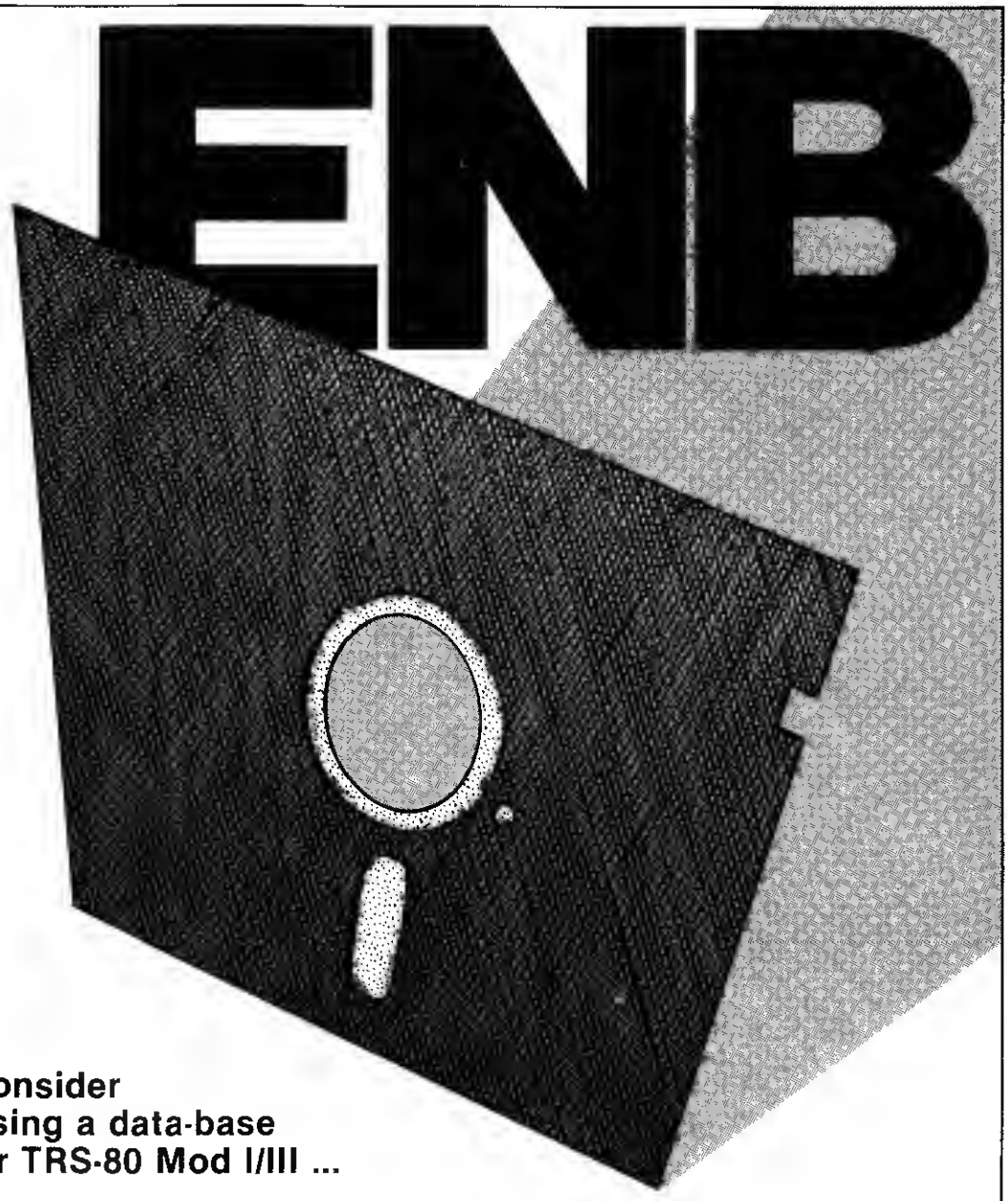

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Build an EPROM Programmer

by William Mahoney

Wouldn't it be convenient to have all your favorite programs put into ROM packs? Doing it yourself can save time and money.

Commercially marketed Color Computer programs come in small, plug-in plastic cartridges called ROM packs. Program instructions are permanently burned into the ROM chips within each package.

Alternatively, user-developed programs are saved on cassette tapes and loaded from the tape when desired, a time-consuming process. It would be easier to have often-used or favorite programs stored in ROM packs for fast, easy loading.

Some companies will burn programs into ROM chips for you, but it's costly and inconvenient. And if a program bug shows up afterward, the pack has to be reprogrammed, an expensive proposition.

Users can incorporate their programs on ROM chips with an EPROM (erasable programmable read-only memory) programmer. I designed an EPROM programmer for the 2716, 2732, 2532, 2764, and 2564 EPROM chips.

In addition to saving programs in ROM packs, you can replace Radio Shack's 8K ROM operating system with a 2564 chip programmed to suit your own operating system needs.

The EPROM programmer I designed is easy to build and should cost under $85. All the parts are obtained either at Radio Shack or through mail-order advertisements found in most computer or electronics magazines.

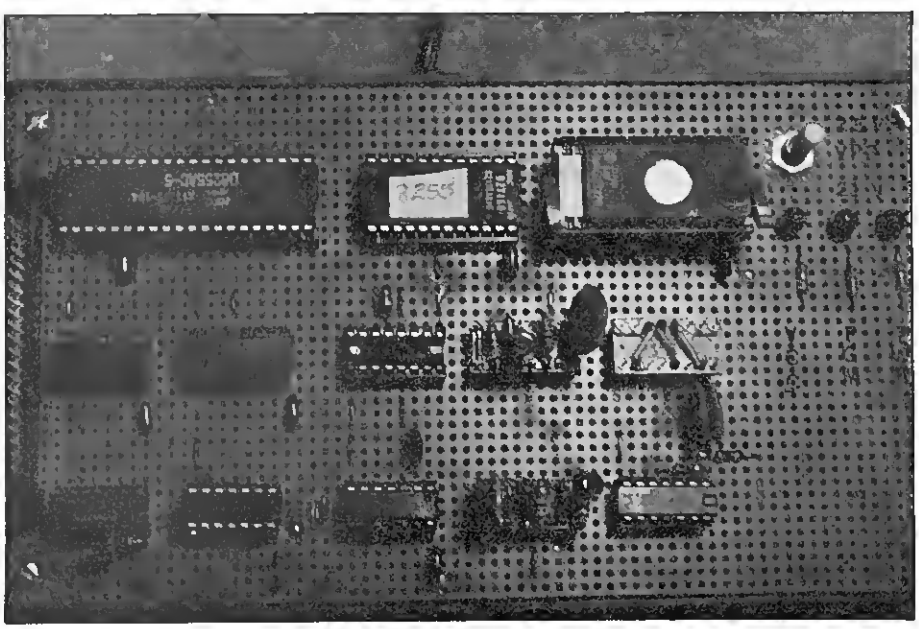

Photo 1

Software

The driver program, written in Assembly language, is about 1,454 (decimal) bytes long and is relocatable, menu-driven, and self-prompting. Although somewhat long, the program features complete error-checking of all user responses and lets you break from any operation that takes longer than a few seconds to execute. It has been thoroughly tested and should be crash-resistant and bug-free.

Program Listing 1 is configured to reside in a 2716 EPROM as part of the programmer. The program has 17 vari-

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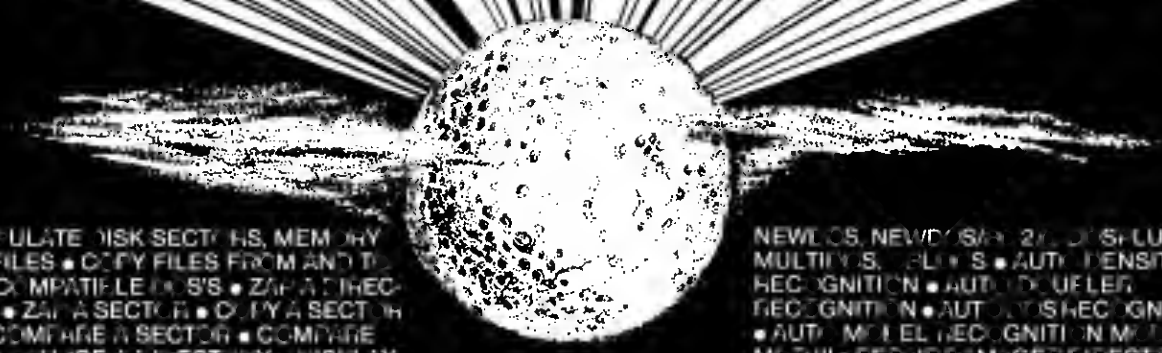

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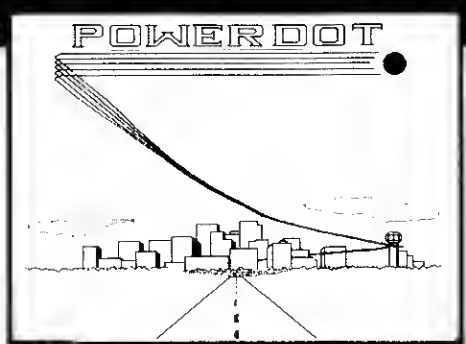

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ables placed in memory locations $0600–$0619. The rest of memory (up to the stack) is available for the buffer.

If you have a 4K system, the programmer is somewhat complicated to use since you have only enough buffer space to program a 2716 EPROM in a single pass. You can program larger EPROMs in segments of about 2K each. Since you probably won't be able to use an editor/assembler to enter the program, you need either a monitor or a hex loader to enter the machine code from the listing.

Programmer
Integrated Circuits

AB1	8255-5	Programmable Peripheral Interface
A2	74LS74	Flip-flop
A3	74121	Monostable multivibrator (one-shot)
B2	74LS138	One-of-eight decoder
B3	74LS08	Quad 2-input and gate
C1	2716	2K X 8 EPROM
C2	7476	Dual J-K flip-flop
C3	556	Dual timer (555 can be used)
E3	7406	Hex inverting buffer, open collector
Q1,Q2	2N2222A	NPN transistor
D1-D4	1N914	Signal diode
D5	1N4731	Zener diode, 4.3 V
R1	12k	¼ watt 5 percent resistor
R2-R8	1k	¼ watt 5 percent resistor
R13	240k	¼ watt 5 percent resistor
R12	620k	¼ watt 5 percent resistor
R14	82 Ohm	¼ watt 5 percent resistor
R9	15k	¼ watt 5 percent resistor
R10	7.5k	¼ watt 5 percent resistor
C1	100 pF	Disk capacitor (50 V)
C3	.01 μF	Disk capacitor (50 V)
C4-C15	.1 μF	Disk capacitor (50 V)
C2	1.0 μF	Metal film capacitor (other values may also work)
S1	DPDT	Miniature switch, ON-OFF-ON

Sockets

Qty	Size	
5	16 pin	Wire-wrap socket
5	14 pin	Wire-wrap socket
1	24 pin	Wire-wrap socket
1	28 pin	Wire-wrap socket
1	40 pin	Wire-wrap socket
1	28 pin	Zero insertion force socket

Miscellaneous: Three LEDs, chassis box (7 3/4″ × 4 3/8″ × 2 3/8″), perfboard (sized to fit chassis box), seven 16-pin DIP headers, solder, wire-wrap wire, hookup wire, 18″ long 40-conductor ribbon cable, 40-pin ribbon cable connector socket, 40-pin wire-wrap ribbon cable DIP header, 40-pin male card-edge type ribbon cable connector (see text).

Power Supply

IC1	LM317T	Adjustable voltage regulator (TO220 case)
IC2	7805	5 V voltage regulator
D1,D2	1N4002	100 V, 1.0 A rectifiers
R2	3.9k	¼-watt 5 percent resistor
R1	240 Ohm	¼-watt 5 percent resistor
R3	2k	10-turn pot (1k should also work)
C3,C4	.1 μF	50 V disk capacitor
C5,C6	1.0 μF	50 V non-electrolytic capacitor (or 22 μF 30 V electrolytic)
C1,C2	1000 μF	50 V electrolytic capacitors
T1	12 V, 1.0 A	Wall plug transformer
F1	1/2 A	Quick-blo fuse
S2	SPST	Rocker switch

Miscellaneous: 1 set coax plug/jacks (Radio Shack catalog number 274-1549, 274-1551), wire-wrap pins, four 3/4″ standoffs, four 5/16″ standoffs, eight screws to fit standoffs, two pair 3-pin Molex connectors, chassis mount fuse holder, epoxy, heat sink (see text), perfboard (2¾″ × 3¾″)

Table 1. Parts List

Features

The program confirms whether the EPROM is blank, and displays any incorrect locations. You can also program from a master ROM, input data from the keyboard, and program as few or as many locations as you wish. After any program ROM operation, the programmed locations are automatically verified. Any incorrect locations are displayed on the screen.

The EPROM programmer recognizes three commands in addition to prompted responses: down arrow, up arrow, and menu (M-key).

When you enter addresses, the up-arrow key erases the address you're working on and lets you reenter it. The down-arrow key lets you skip the current entry and use the last value entered for that request.

When entering hex data for the input routine, the up-arrow key displays the previous buffer location. When the down-arrow key is used, the next buffer location is displayed.

The M command is recognized any time you enter hex data or addresses, as well as during the program ROM operation. Pressing M immediately returns you to the menu. Any time a verify operation fails, the program displays the address, fail data (data that was incorrect), expect data (data that should be there but isn't), and gives you the option of continuing the verification. Answering no to this prompt returns you to the menu. (The M command is not recognized in this case nor is it accepted during the too-brief verify and learn ROM operations.)

Operation

The EPROM programmer is straightforward and simple to use. With both the computer and the programmer turned off, plug the programmer connector into the computer ROM pack port. Turn the programmer and computer on. You should start by checking that your EPROM is blank.

First turn S1 off, insert the proper personality module, put the EPROM in the programmer socket, and then select the proper voltage programmer (VPP) level (25 or 21 volts) with S1.

Select option 1 (Verify Blank ROM) and give the appropriate start and stop addresses in hex; prefixes such as $ or &H are unnecessary and will be rejected. If you enter an invalid character, the line is erased and you must reenter the address. If you enter an incorrect

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number, press the up-arrow key and enter the correct number. To use the same address used in a previous operation, hit the down-arrow key and the program defaults to the previous number.

After entering the start and stop addresses, you are asked if you want to make any changes. Answer with a Y or N, or use the M command to return to the menu. The addresses you enter are checked; if the start address is greater than the stop address, the addresses are rejected.

Once you confirm that your EPROM is blank, enter the data you want to program. If you use a master ROM (or EPROM), turn S1 off, put the master ROM in the programming socket, plug in the appropriate personality module, and turn S1 back on. Then select option 2, Learn ROM. You are asked to enter those addresses you wish to copy. The program reads the specified addresses, loads them into the buffer, and returns you to the menu.

If you are using a listing, select option 3 (Input Data) and enter the desired addresses. You are asked to enter hex data while the screen displays each address and its contents. If you don't want to change the contents of a location, the down-arrow key skips to the next location. Use the up-arrow key to revert to a previous location. The program does not let you step back beyond location zero. When you reach the stop address, you are returned to the menu. The rules of address entries apply to wrong or invalid entries as well.

After you enter the data, you are ready to program the EPROM. Turn switch S1 off, and put your blank EPROM back in the programming socket. Turn S1 back on and select option 4, Program ROM.

If you want to use the same start and stop addresses used previously, use the down-arrow key to answer address requests. After answering no to the change address question, the programming operation begins and the VPP LED comes on.

Programming takes about two minutes and 24 seconds for 16K; four minutes and 40 seconds for 32K; and nine minutes and seven seconds for 64K EPROMs. The EPROM is verified after the programming operation is finished, and then returns to the menu.

Long cassette tape programs can be put in EPROMs by using option 5, Move Buffer. CLOADM your program as you normally would. If necessary, add an offset address to put the program above $0619 so it doesn't get partially overwritten by the EPROM programmer variables.

Type the command EXEC &HC000, and control passes to the programmer. Select option 5 and enter the first (start) address of your program. Stop addresses are not used, but you should still enter any number higher than the start address. Then, when you return to the menu, select option 4, Program ROM. This time, enter the EPROM start and stop addresses you want to use. Note that these are not the start and stop addresses of your program as it resides in the computer memory.

For example, assume you have a program that is 1232 decimal ($4D0) bytes long that you want to program into the first 1232 locations of your EPROM. Assume also that, when loaded from tape, the program's start address is $0F00 while the last address is $13D0. When you run option 5, Move Buffer, enter 0F00 for the start and stop addresses. Under option 4, you would enter 0000 for the start address, and 04CF for the stop address. When programming from location 0000, stop addresses are always one number less than the length of the data because location 0000 is the first actual address.

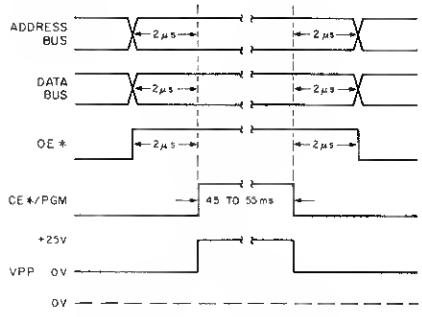

Fig. 1A. 2716 Program Timing

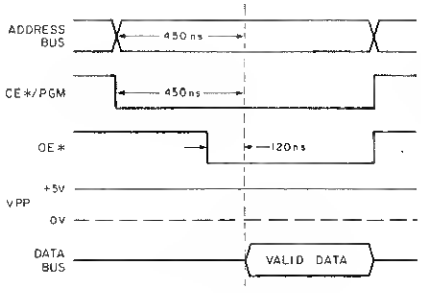

Fig. 1B. 2716 Read Timing

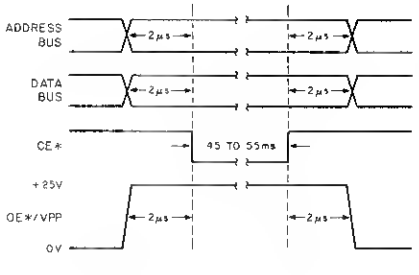

Fig. 2A. 2732 Program Timing

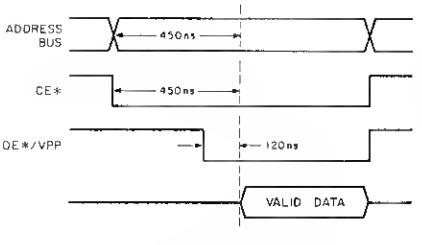

Fig. 2B. 2732 Read Timing

EPROM Programming

Figures 1–5 are simplified timing diagrams of the EPROMs for which the programmer was designed. Figure 1A shows the essential timing requirements for programming a 2716 5-volt EPROM. This device requires a set of address lines, a set of data lines, an output enable (OE) signal, a chip enable/program (CE*/PGM) signal, and a VPP input. As shown, the address and data lines, as well as the OE* signal, must be valid and stable for a minimum of 2 μs (microseconds) before the programming signal (CE*/PGM) goes high. Additionally, the VPP line must be set to 25 V prior to pulsing the CE*/PGM signal.

After meeting these requirements, the CE*/PGM line pulses high for 45 ms (milliseconds) to 55 ms. After the CE*/PGM pulse goes low, the address, data, and OE* lines must remain valid and stable for at least 2 μs. The VPP line can remain high if another location is to be programmed. At this point the data present on the eight data lines is programmed into the location specified by the address lines.

To read the contents of a 2716 EPROM, you must follow the waveforms shown in Fig. 1B. The address lines must be valid and stable, and the CE*/PGM line has to be low for 450 ns (nanoseconds). The OE* line must be low for at least 120 ns. Once these conditions are met, the data output from the EPROM is valid and can be read. Data out remains valid until one of the input signals changes.

To program a 2732 EPROM (Fig. 2A), the VPP level is applied to the OE*/VPP pin instead of a separate pin, and the CE* signal must pulse from a high to a low during programming. In this case, the OE*/VPP line has to go to the VPP level (25 V) at least 2 μs prior to pulsing the CE* signal, and must remain at that level for at least 2 μs after

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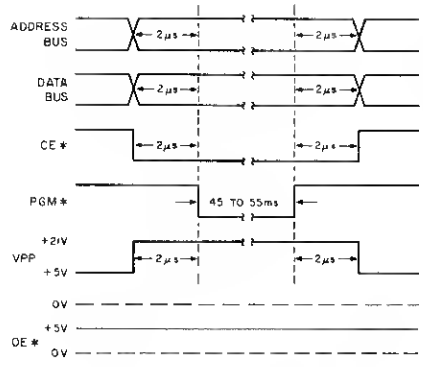

Fig. 3A. 2764 Program Timing

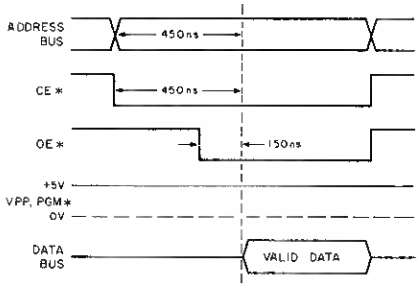

Fig. 3B. 2764 Read Timing

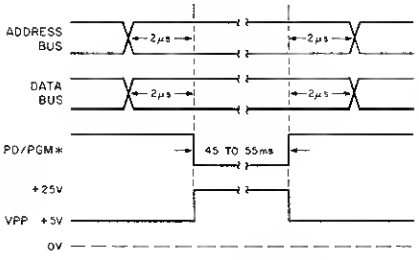

Fig. 4A. 2532 Programming Timing

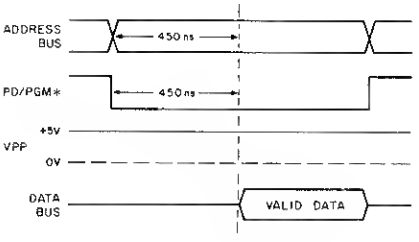

Fig. 4B. 2532 Read Timing

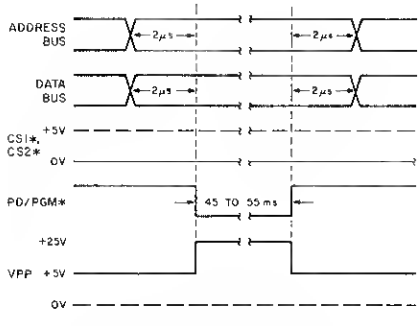

Fig. 5A. 2564 Program Timing

CE* returns high. As with the 2716, CE* must be active for 45 ms to 55 ms. Read timing of the 2732 is identical to that of the 2716.

There are no dual function pins with the 2764. One important difference with

"You can construct a simple programmer which, with the use of personality modules, lets you program [all five EPROMs]."

the 2764 is that the VPP is 21 ± .5 V, as compared to the 25 ± 1 V maximum for the 2716 and 2732 chips. The CE* line must now go from high to low (Fig. 3A), and VPP must go to 25 V at least 2 μs prior to the programming pulse (PGM*). OE* should be high during the entire operation.

To read a 2764 EPROM, the OE* line must go from high to low 150 ns before data out is valid. In addition, the VPP and PGM* pins have to be pulled high to enable the read operation. All other read timing is the same as for the other EPROMs.

The 2532 EPROM has one less control line (Fig. 4A) than the other devices. The timing requirements for address and data lines remain the same, as does the programming pulse (PD/PGM*). Reading a 2532 is simply a matter of applying address signals and putting PD/PGM* low. Then, 450 ns later, valid data is available at the output pins.

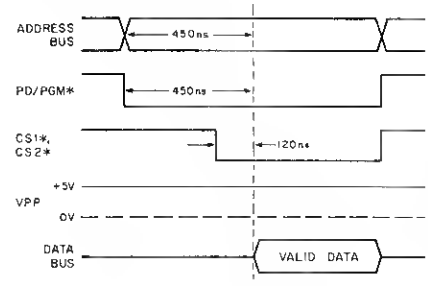

Fig. 5B. 2564 Read Timing

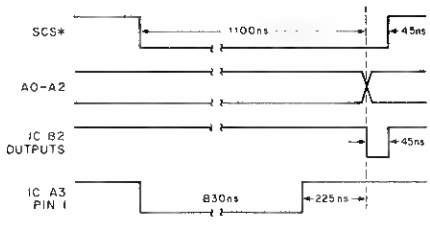

Fig. 6. SCS Timing*

Figure 5A shows that the 2564 EPROM has a few more control signals than the 2532. Address and data timing are once again unchanged, and the programming pulse (PD/PGM*) is identical to that of the 2532. VPP has its own pin, as in the 2764, but there are two additional select lines, CS1* and CS2*. These lines must be low for both programming and reading. Reading is done as in the 2532 except that the two select lines have to be held low during the entire read cycle.

With all the similarities between these five EPROMs, you can construct a simple programmer which, with the use of personality modules, lets you program all these devices. Personality modules let you connect each EPROM's control, programming, and upper address lines to the proper signal from the programmer.

Theory of Operation

The heart of the EPROM programmer is the 8255 PPI IC (programmable peripheral interface integrated circuit). The PPI provides three bidirectional ports and is nearly ideal for this application. The 8255 PPI has one control register and three basic operating modes.

In mode zero, the simplest of the three ports is programmed to be either an input or output register. Since the EPROM programmer needs only one bidirectional port, I programmed ports A and B as outputs only while port C is used for both read and write (programming) operations. The PPI uses two address lines (A0 and A1), a low true chip select (CS*) signal, a high true reset (RST), a low true read (R*) signal, and a low true write (W*) signal.

When the PPI is selected, address 00 selects port A, address 01 selects port B, and address 02 selects port C, while address 03 selects the control register. Writing $89 to the control register makes ports A and B outputs, and makes port C an input used to read the EPROM. Writing $80 to the control register makes all three ports outputs, and is used to program the EPROM.

I soon discovered that the timing relationship between the Color Computer R/W* signal and address lines is incompatible with the PPI. During a write cycle, the R/W* line of the Color Computer remains low for about 10 ns after the address lines change for the next instruction cycle. According to the 8255 specifications, the address lines should not change until 20 ns after the W* line

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returns high. By reducing the amount of time that the R/W* signal from the computer is low, I programmed the PPI without difficulty.

I used a 74LS74 (IC A2, Fig. 7) flip-flop and the Color Computer Q clock signal to reduce the amount of time the R/W* signal is low during a write cycle. R/W* is connected to the set input while the Q clock is applied to the reset input of the flip-flop. The flip-flop Q output is used for the PPI R* signal, and the flip-flop Q* output is used for the PPI W* signal.

Using the 74LS74 flip-flop in this manner produces a W* pulse for the PPI that ends about 300 ns before the addresses change. There is no change in the R* signal (other than being inverted), but this is no problem since the critical part of a read operation is at the beginning of the cycle.

In Fig. 7, IC B2, a one-of-eight decoder, uses address lines A0–A2 and SCS* (spare chip select) to select the desired function of the programmer. Unfortunately, the SCS* signal (Fig. 6) stays true, or low, for about 44 ns after the address lines changes. This causes IC B2 to generate a pulse on whatever output is decoded from the new information on address lines A0–A2. This, in turn, causes spurious setting and resetting of the flip-flops used in the programmer. Using a 74121 (IC A3) one-shot reduces the SCS* width enough to avoid this problem.

By using SCS* with the programmer, I eliminated the need for any further decoding circuitry. SCS* is generated when address locations between $FF40 and $FF5F are selected. The EPROM programmer uses only addresses $FF40 through $FF47, but since other locations decoded by SCS* aren't addressed, this partial decoding causes no problems.

Gates B3-B, B3-C, and B3-D provide CS* to the PPI for addresses $FF40–$FF43, the PPI port and control addresses. $FF44 produces ROMEN* (ROM enable), while $FF45 produces PLEN* (pulse enable—the programming pulse). VPPEN* (VPP voltage enable) is produced by address $FF46, and RST* (reset) is generated by address $FF47. Since the PPI requires a high true reset, E3-B inverts the low true RST* produced by IC B2. ROMEN*, when decoded, sets C2-A. The resulting low from pin 14 produces OE* for reading the 2716 and 2764 EPROMs. This same signal also provides a low by way of B3-A (PD/PGM* and CE*) to enable 2532, 2564, and 2732 EPROMs for reading.

IC C2-B, when set by VPPEN*, produces a low on pin 10. This low is inverted by E3-C, and turns on transistors Q1 and Q2. When Q1 and Q2 are on, the VPP programming voltage is available at the emitter of each transistor. Two separate VPP outputs are provided because the 2732 EPROM requires its OE*/VPP pin to be low for a read,

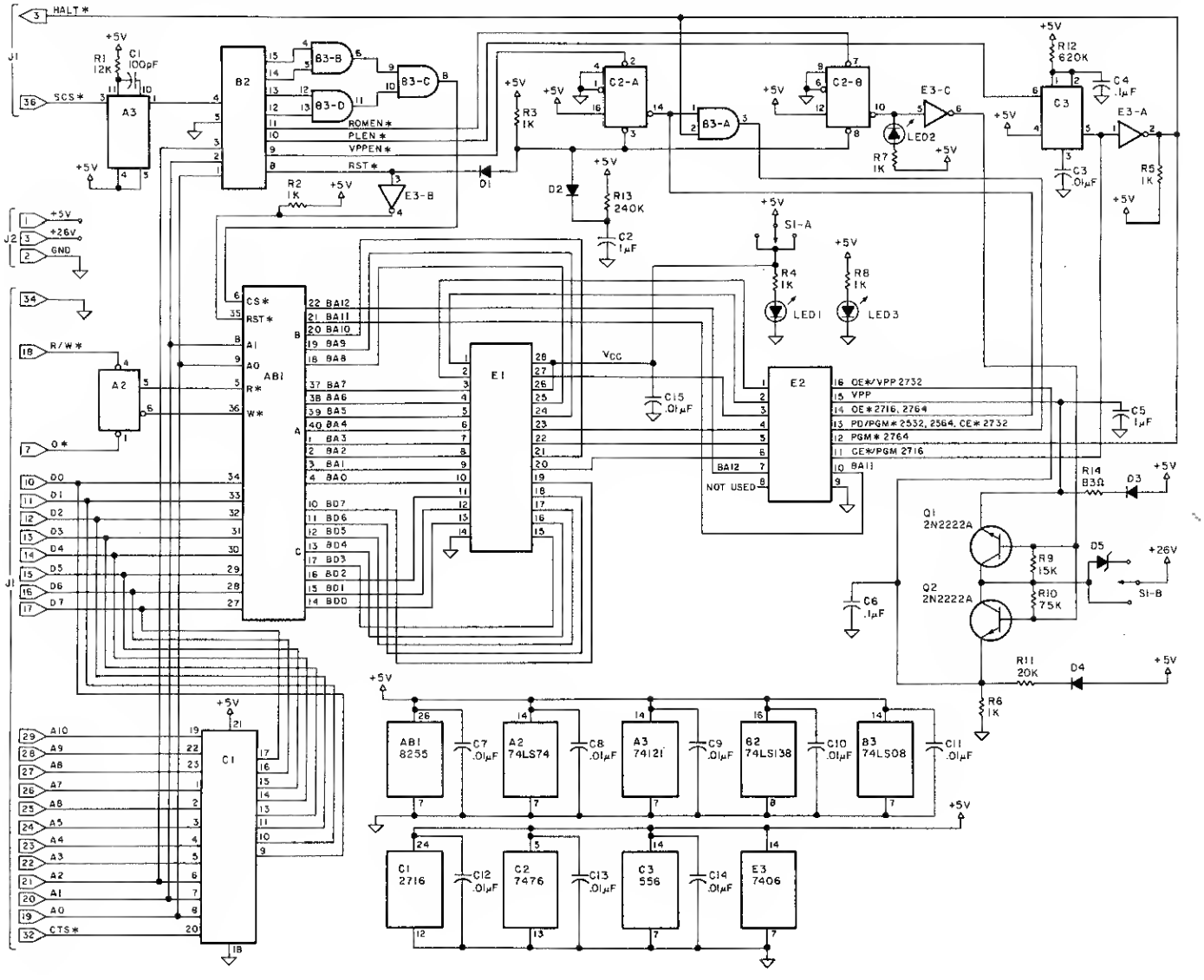

Fig. 7. EPROM Programmer Schematic

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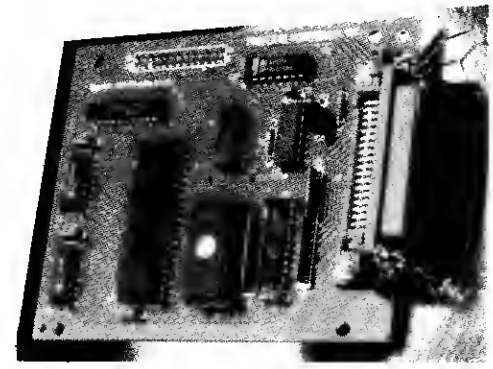

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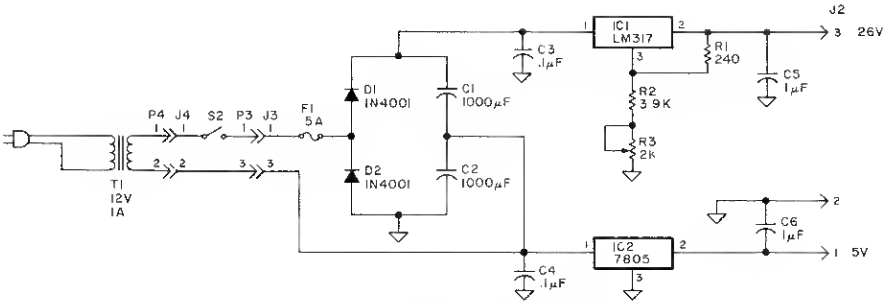

Fig. 8. Power Supply Schematic

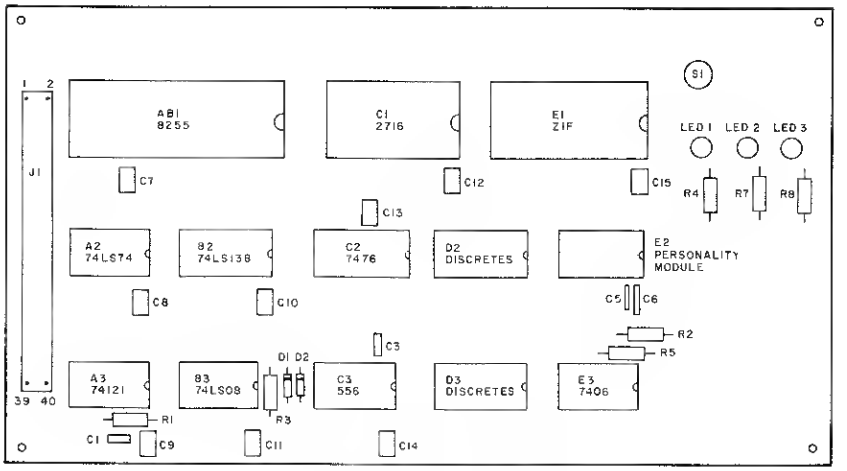

Fig. 9. Programmer Parts Layout

with 25 V applied for programming. The other EPROMs require their VPP pins to be pulled high for a read.

When Q1 is turned off (Q1 and Q2 are always off when you aren't programming), the VPP input is slightly less than 5 V through D3 and R8. When Q2 is turned off, its emitter voltage is less than a volt due to the voltage divider consisting of R11 and R6. Diodes D3 and D4 provide isolation between the 5 V and 26 V power supplies. Capacitors C5 and C6 at the emitters of Q1 and Q2 reduce overshoot of VPP that could damage the EPROMs. LED2 (light emitting diode) indicates when the VPP programming voltage is applied to the EPROM.

IC C3 is a 556 dual timer used to provide the programming pulse for the EPROMs. Resistor R12 and capacitor C4 are selected to provide a 50 ms low-to-high pulse. This pulse is used directly for the 2716 (CE*/PGM), and is inverted for the 2764 (PGM*) by IC E3-A. This same inverted pulse is applied to the 2732, 2564, and 2532 (CE* and PD/PGM*) by way of B3-A. In addition, the inverted pulse is also applied to the Color Computer HALT* line which causes the computer to cease ex-

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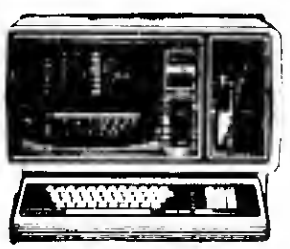

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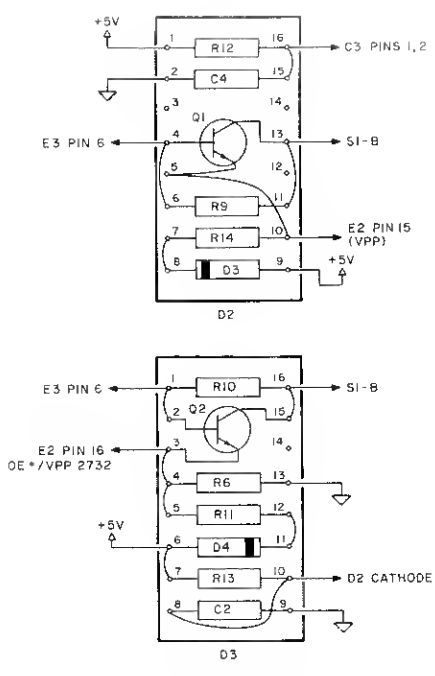

Fig. 10. Discrete Headers

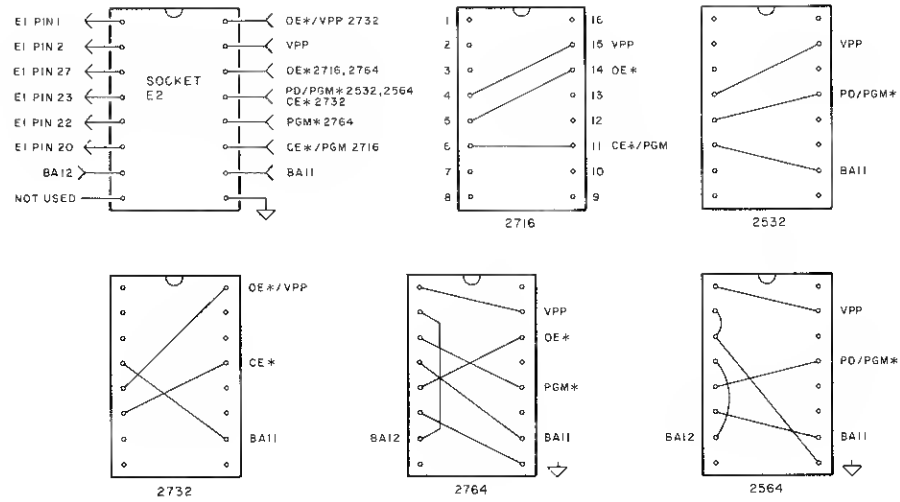

Fig. 11. Personality Modules

ecuting instructions until the HALT* line returns high.

R13 and C2 provide a power-on-reset function. D1, D2, and R3 provide an AND function to gate the power-on-reset and the decoded RST* for IC C2. Using discrete components in this way creates a needed AND gate without having to add another IC.

E2 is an 18-pin socket used to hold the personality modules. Pins 1–7, 9, and 10 are outputs to the EPROM programming socket E1, while pins 11–16 are inputs from the control circuitry. IC C1 is a 2716 EPROM that contains the program to control the programmer. This EPROM uses CTS* (cartridge select) from the computer, and is addressed starting at $C000.

S1 removes VCC from the EPROM programming socket so the EPROMs can be removed and inserted without turning off the programmer. S1 also removes the 26 V supply from Q1 and Q2 to prevent an accidental application of VPP to the EPROM when VCC is off, and allows selection of the correct VPP level. Zener diode D5 reduces

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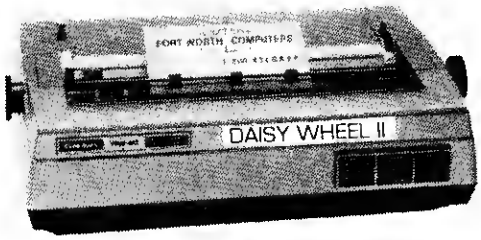

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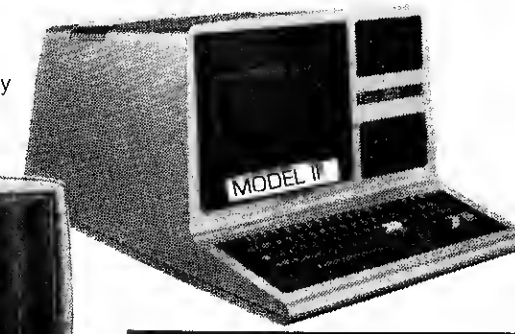

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VPP to 21 V for the 2764 EPROM. LED1 turns on whenever VCC is applied to the EPROM programming socket. LED3 is the power-on indicator.

Power Supply

Figure 8 shows the power supply used for the EPROM programmer. T1 is a 12 V 1.0 A (ampere) wall plug transformer. D1, D2, C1, and C2 form a full-wave voltage doubler that produces approximately 34 V. A tap at the junction of C1 and C2 applies 15 V to a 7805 voltage regulator that generates 5 V. This 5 V supply powers all the logic used in the programmer. IC1 is an LM317 adjustable voltage regulator that uses resistors R1, R2, and variable resistor R3 to provide the necessary adjustment to obtain 26 V. Capacitors C3, C4, C5, and C6 provide transient (voltage spikes or noise) suppression for the regulator ICs.

Selecting Parts

The only component that might be difficult to find is the 40-pin male card-edge type connector. This connector mates with the Color Computer ROM-pack socket, and the only thing I could find in the mail-order catalogs was a 34-pin version used to make disk-drive extender cables. I finally found one at a local outlet after I had completed the project. If you cannot find such a connector, you can build one out of a 40-pin ribbon cable edge connector (Radio Shack catalog number 276-1558) and a small piece of two-sided PC (printed circuit) board stock.

All other parts are available from either Radio Shack or mail-order outlets. I purchased my chassis box from Radio Shack (catalog number 270-232), while my perfboard is a Vector 163677-6DP. This board has a set of power and ground buses, and is nice to use, if expensive. If you use this board, you should cut the buses away from a portion of one end to prevent shorting the 40-pin DIP header pins together.

You can also use plain perfboard and wire-wrap all power and ground connections. If you use this method I suggest you solder the bypass capacitors to wire-wrap pins or directly to the IC socket pins. The discrete AND gate parts and the 74121 timing components are installed the same way.

Building the Programmer

Using the top that comes with the chassis box as a pattern, trim your perfboard and drill four screw holes to fit the top of the box. Then install the IC sockets. Parts layout is not critical,

"Connectors make life easier if you have to remove the board for any reason."

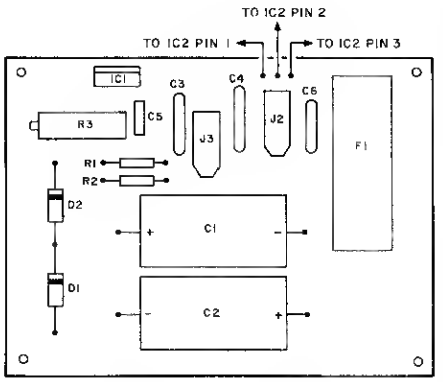

Fig. 12. Power Supply Layout

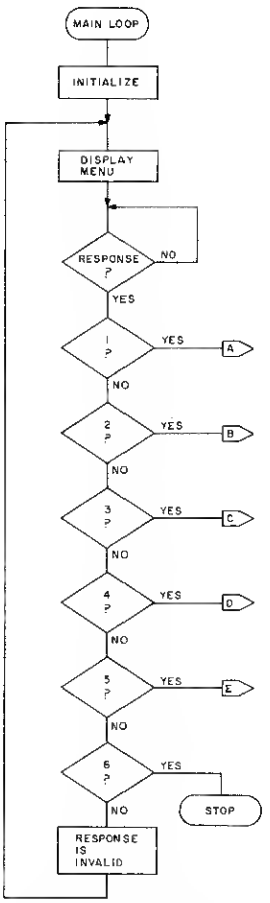

Fig. 13. Main Loop Flowchart

and you can use either my layout (shown in Fig. 9) or any layout convenient for you.

If you are using plain perfboard, a super-glue will hold the sockets and wire-wrap pins in place. Next, install the bypass capacitors, the discrete AND gate, the 74121 timing components, S1, and the three LEDs with their current-limiting resistors (R4, R7, R8). Mount pull-up resistors R5 and R2 as shown in Fig. 9.

Install the 40-pin wire-wrap DIP header as shown, noting the location of pin 1. As each wire-wrap is made, be sure to check it off on the diagram to avoid confusion. Connections to switch S1 are soldered, and the LED connections are either soldered or wire-wrapped using wire-wrap pins. When you finish wire-wrapping, use hookup wire and one of the 3-pin Molex connectors to make a three- to four-inch power supply cable. You should have a connection to ground, 5 V, and 26 V.

Next, assemble the discrete components on the DIP headers that plug into sockets D2 and D3. Refer to Fig. 10 for component placement. Solder these components as quickly as possible and use a low-wattage iron to avoid melting the headers. Pay special attention to mounting the two transistors to ensure that the leads don't touch each other. Now, using an ohmmeter, check your wiring against the schematic. Be sure that the ground and power buses are not shorted together, and that ground is connected to the correct pin on J1.

Personality Modules

Now is a good time to build the personality modules. These modules are simple 16-pin DIP headers with jumper wires soldered to the appropriate pins. Follow the pictorial in Fig. 11, and you should have no problems.

Power Supply Assembly

Next, the power supply is constructed on the 2¾-by-3¾ perfboard. I used a grid board from Radio Shack (catalog number 276-158), but plain perfboard will do. The power supply board is constructed by soldering each component to wire-wrap pins and then wire-wrapping the underside. Refer to Fig. 12 for the layout. I use two 3-pin Molex connectors to make connections to the power supply board. You can solder these connections directly to the board, but connectors make life easier if you have to remove the board for any reason.

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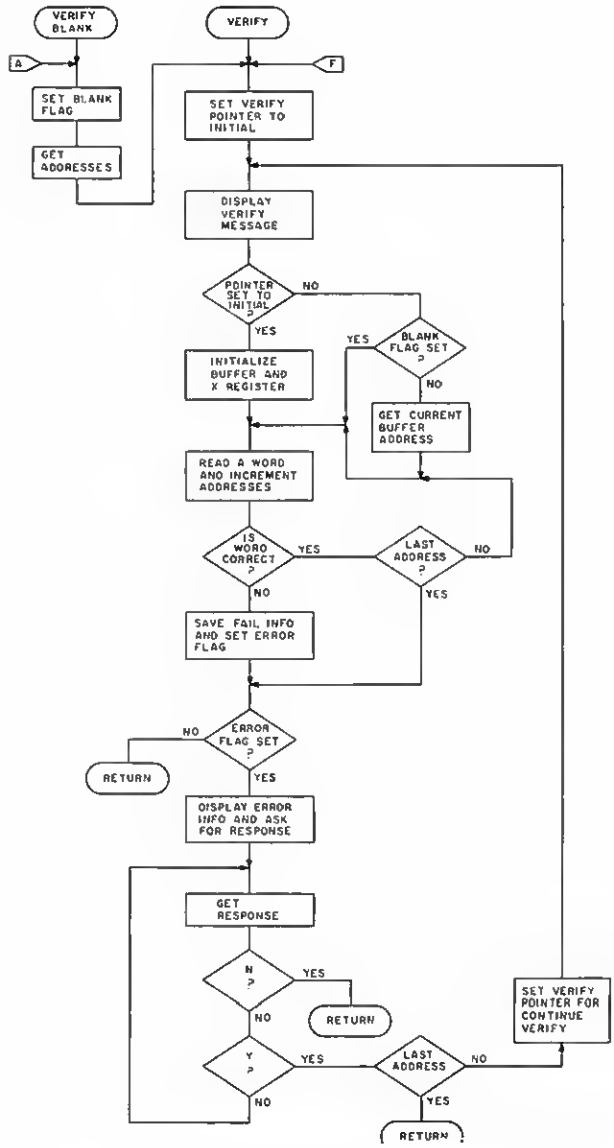

Fig. 14. Verify Routine Flowchart

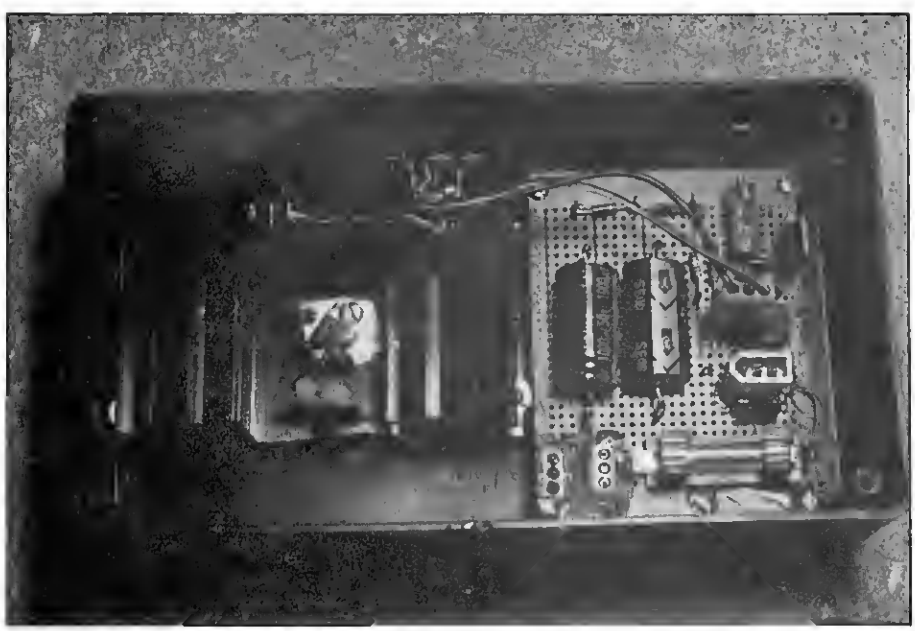

Photo 2. Interior View

supply board uses only two pins, while the connector supplying power to the programmer board uses all three pins. To avoid plugging the cables into the wrong place, make one of the connectors on the power supply board a male connector and the other a female connector. Since the pin spacing does not exactly match the grid spacing on the board, you must slightly squeeze together or stretch apart the solder tails to get them to fit. If your Molex pins are the crimp-on style, you can use 1/4-inch bare hookup wire crimped or soldered into each pin as a solder tail. Use epoxy to anchor the connectors to the board, as solder connections alone are not strong enough to stand up to repeated use of the connectors. Epoxy can also fasten the fuse holder in place. IC2, the 5 V regulator, needs to be well heat sinked. I used a large heat sink (similar to Radio Shack catalog number 276-1361) cut in half to fit inside the chassis box (see Photo 2). Don't forget to check your wiring against the schematic with an ohmmeter. Pay special attention to the voltage regulators. If these are wired wrong, they could be destroyed when you apply power.

Prepare the Chassis Box

Mounting holes are cut in the back of the chassis box for the SPST rocker switch S2 and the chassis-mounted coax power jack. Note also the access hole in the rear of the chassis box to allow adjustment of the 26 V power supply. I used 3/4-inch nylon standoffs to mount the power supply board and 5/16-inch standoffs for the heat sink. These standoffs are attached to the power supply board and heat sink with small screws and epoxied to the box. Be sure to roughen the bottom of the chassis box with coarse sandpaper or the epoxy won't adhere well to the bakelite material.

When the epoxy is dry, finish wiring the power supply. Following the power supply schematic, wire IC2 to the three tie points on the power supply board. Connect the chassis-mounted coax power jack, switch S2, and the remaining Molex connector. Plug this connector into the matching connector on the power supply board. Wire the inline coax power plug to the wall plug transformer, and check your wiring. Connect the wall plug transformer to the chassis-mounted jack, plug the transformer into an ac outlet, and turn on S2.

Measure the voltage at the output Molex connector. The 5 V output pin should measure true. The 26 V pin read-

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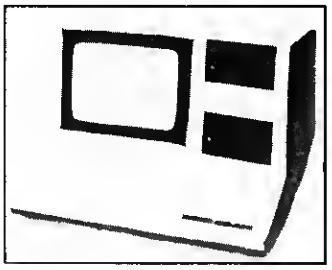

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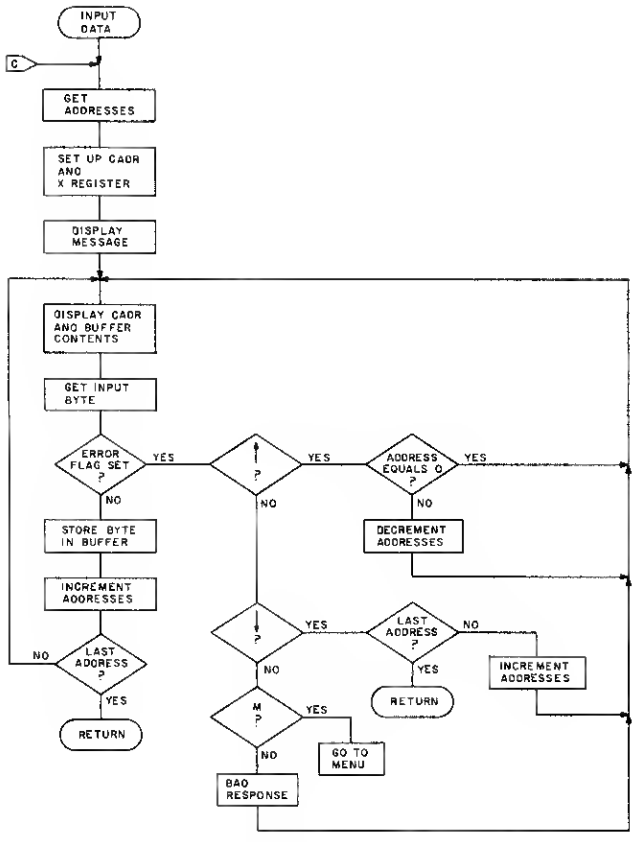

Fig. 15. Input Routine Flowchart

ing varies, but you should be able to get 26 V using the pot (potentiometer or variable resistor). If you don't get either of these voltages, or if the fuse blows, immediately remove power and recheck your wiring. Do not attempt to connect the power supply to the programmer board until you have found and corrected any problems in the power supply.

Once you're sure the power supply is working properly, remove power and connect the programmer board power connector to the power supply output connector. You should not have any ICs or DIP headers plugged into the board. Turn the unit on and make sure that LED3 (power-on) is on. Turn S1 on and verify that LED1 (VCC) is on. Use a voltmeter to ensure that you have the ground and correct voltages at the appropriate pins of each IC socket. When you are sure that the power and ground connections are correct, turn off the power and disconnect the programmer board from the power supply.

The Computer Connection

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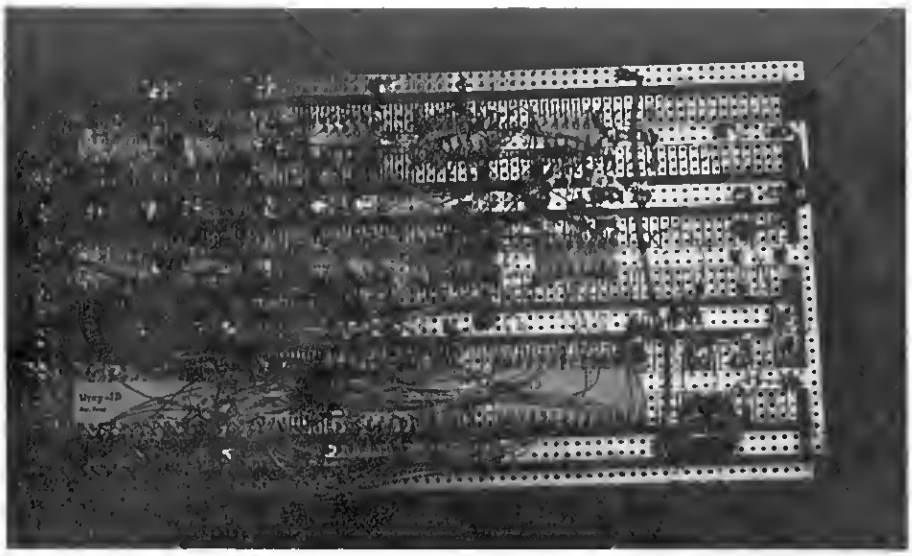

Photo 3. Wiring Side of Programmer

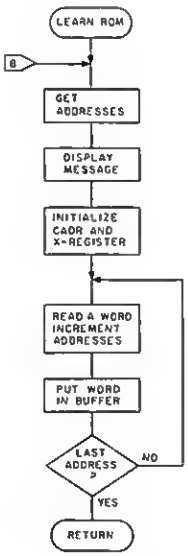

Fig. 16. Learn ROM Routine Flowchart

(Radio Shack catalog number 276-1558) and a piece of two-sided, copper-clad PC board. The board has to be about 2 3/32 inches wide and at least 3/4 inch long. If you make the board longer, it will be easier to plug it into the computer ROM-pack port, but you must be sure that it doesn't touch any metal surfaces.

Once you cut the board down to size, check it for fit by inserting it into your ribbon-cable connector. You may have to file the edges and to bevel or round off all four corners to ease the fit.

Next, mask off 40 traces on the board—20 on each side. Use etch-resistant dry transfers made by Datak Corp. Their assortment package of dry transfers includes a sheet of straight-line traces perfectly spaced to match the ROM-pack port connector.

Follow the directions included with the transfers and apply 20 traces to each side of the board, making sure each is centered. It should take only about 15 or 20 minutes to etch the board with Datak's etchant; another brand might

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Photo 4. Two Types of Programmer-to-Computer Cables

take longer. Be sure you are in a well-ventilated area when working with the etchant.

If you can't find Datak transfers, you can use a roll of printed circuit tape or a resist-ink pen and a straight edge to make the traces. Measure carefully to get the correct contact spacing for the board. You can measure either the ribbon cable card-edge connector or a ROM-pack edge connector to get the dimensions.

If you don't like etching boards, try one of the blank ROM packs offered by some of the companies that support the Color Computer. You can't use Radio Shack ROM-pack boards because they don't have all the necessary contacts.

Once you finish your connector, you're ready to build your cable. If you are using a male card-edge type connector, you need something to hold the contacts in place while you press the connector onto the cable. A female connector works fine for this. Simply insert the male connector into the female connector and use a vise to press the male connector onto the 18-inch ribbon cable. Remove the female connector and carefully inspect the contacts of the male connector. If they appear pushed out of position, use a pencil or needle-nosed pliers to push them back into place. If you are using the female connector and PC board, simply press the connector onto the cable and insert the board. Next, press the 40-pin socket connector onto the other end of the cable. Make sure that the contacts of each connector are on the same side of the ribbon cable (see Photo 4).

Check It Out

Test the programmer in stages. Any time you don't get the proper indications, you should turn off all power to the computer and programmer immediately and refer to the troubleshooting section.

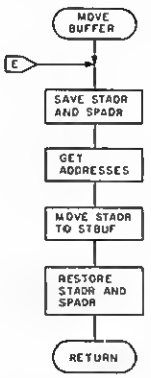

Fig. 17. Move Buffer Routine Flowchart

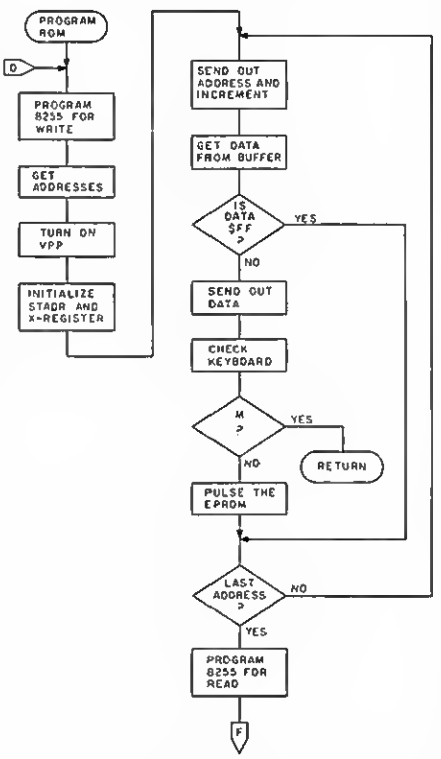

Fig. 18. Program ROM Routine Flowchart

With the Color Computer off, plug the male connector into the ROM-pack port. The cable should come out from beneath the connector. As you plug in the male connector, the pin on top and nearest to the back of the computer is pin 1. You can use an ohmmeter to be sure that this pin connects to pin 1 of the 40-pin header on the programmer board. The other end of the cable plugs into the programmer board and should not be twisted or folded over the top of the connector. The programmer board should still have no components plugged into the sockets, and should not be connected to the power supply board. Place the programmer board bottom-up on a nonconducting surface.

Connect a voltmeter between pins 1 (−12 V) and 34 (ground) of the 40-pin header on the programmer board. Be certain that the meter leads don't touch adjacent pins. Turn on the computer and the meter should indicate −12 V. If you measure any other voltage, or if the computer does not start up as usual, immediately remove the power and locate the problem.

Final Assembly and Checkout

You can now install the ICs and the DIP headers with the discrete components. With the programmer disconnected from the computer, turn S1 off and turn on the programmer. Check the ICs for any signs of overheating. While they may get warm, none of them should be hot to the touch. If anything is getting hot, remove the power and find the problem before continuing. When everything seems in order, turn S1 on. The VCC light (LED1) should be on. Measure the transistor cases and you should have +26 V; if not, adjust the 26 V supply accordingly.

Turn off power to the programmer and connect it to the computer. Turn on the programmer first and then turn the computer on. If the computer doesn't start up properly, you have a problem that must be resolved before you continue.

Once the computer turns on without any problem, and it should at this point, set S1 to the 25 V position and enter the command POKE &HFF46,0. The VPP light (LED2) should come on. Measure the VPP voltage at the emitter of Q1, and adjust the 26 V power supply to get a reading of about 25.5 V. The OE*/VPP output at the emitter of Q2

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should read about 25 V. Enter the command POKE &HFF47,0, and the VPP light should go out.

You are now ready to try out your EPROM programmer. Load and assemble the program, and connect the programmer to the computer with the power off. Then turn everything on. Load the program from tape and enter the command EXEC $3000 (or whatever start address you used).

If everything is running properly, the menu appears. Try running the verify blank ROM routine. I get 00 at every location with an empty socket. Then make sure S1 is off and insert the appropriate personality module and a 2716 EPROM. Select 25 V VPP with S1 and run the verify routine again. If your EPROM is fully erased, the test passes. If your EPROM is not erased, the fail data displays the EPROM contents at the location displayed. The expected data is $FF for this test. If you have a programmed EPROM and know what the contents should be, this is a good check of the address and data bus lines. Resolve any problems before continuing.

Your First EPROM

From the main menu, select the Move Buffer option and set the start address for $3000 and the stop address to any number equal to or greater than $3000. When the menu returns, select the program ROM option. It prompts you for addresses and you should enter 0000 for the start and 05AD for the stop address. After two minutes, the EPROM is programmed and verified.

"If you must troubleshoot for defective parts, a scope is your most valuable tool."

Did everything work as expected? If so, congratulations! You have done well. Now that you have your EPROM programmed, turn S1 off, remove the EPROM, and turn everything off. Put the EPROM in socket C1 and turn everything except S1 back on. Type in the command EXEC &HC000, and the program should be back up and running. To check out the rest of your programmer, obtain a sample of each of the other EPROMs and try programming them. If you can't afford one of each, at least try to get a 2732. If this device works properly, you have verified every signal except EPROM address line BA12, which is used only with the 64K EPROMs.

Troubleshooting

If you have problems at any point, always correct the problem before going any further to prevent possible damage. Check your wiring before looking for defective parts. If you must troubleshoot for defective parts, a scope is your most valuable tool. A logic probe is less helpful, but will probably do in a pinch. Small routines like those shown in Listing 2 help troubleshoot the programmer one section at a time.

If at any time the computer does not start up properly after being turned on with the programmer attached, then the problem is likely in one of two areas: first, check to be sure you aren't shorting out any of the computer power supplies. Since the programmer provides its own power, you should not have any wire-wrap connections to pins 1, 2, and 9 of the 40-pin DIP header.

If this checks out, then the 8255 PPI has probably seized control of the computer. Check pin 6 (CS*) to see if the PPI is being selected. This pin should always be high unless addresses $FF40-$FF43 are selected. These addresses don't appear to be selected during the power-up sequence of the non-disk computer. If the CS* line is low, or has pulses on it, then check ICs B3, B2, and A3 for miswiring or faulty components.

Once the computer is turned on and initialized properly, use the routines shown in Listing 2 should the programmer not work properly. ■

Program Listing 1

```
                    0001          NAM   EPROM   LISTING 1
                    0002
                    0003 * BY WILLIAM R. MAHONEY
                    0004
                    0005 * VARIABLES START AT $600
                    0006 * BUFFER STARTS AT $61A
                    0007
0000                0008 STADR  RMB   2          EPROM START ADDRESS
0002                0009 CADR   RMB   2          EPROM CURRENT ADDRESS
0004                0010 SPADR  RMB   2          EPROM STOP ADDRESS
0006                0011 STBUF  RMB   2          BUFFER START ADDR.
0008                0012 CBUF   RMB   2          CURRENT BUFFER ADDR
000A                0013 ERR    RMB   1          ERROR FLAG
000B                0014 FLADR  RMB   2          EPROM VERIFY FAILED ADDRESS
000D                0015 FLDAT  RMB   1          EPROM VERIFY FAILED DATA
000E                0016 EXDTA  RMB   1          EPROM VERIFY EXPECTED DATA
000F                0017 TEMP   RMB   1          MISCELANEOUS VARIABLE
0010                0018 MSGPT  RMB   2          MESSAGE POINTER
0012                0019 BLNK   RMB   1          VERIFY BLANK EPROM FLAG
0013                0020 VERPT  RMB   2          VERIFY POINTER
0015                0021 STACK  RMB   2          STACK STORAGE
0017                0022 UPFLG  RMB   1          UP ARROW FLAG
0018                0023 DNFLG  RMB   1          DOWN ARROW FLAG
0019                0024 MFLG   RMB   1          "M" FLAG (MENU)
001A                0025 BUFFER RMB   2          BEGIN BUFFER
                    0026
3000                0027        ORG   $3000
                    0028
0088                0029 CURSOR EQU   $0088      SCREEN CURSOR LOCATION
A002                0030 CHROUT EQU   $A002      PUT A CHARACTER OUT TO SCREEN
A928                0031 CLS    EQU   $A928      CLEAR SCREEN
A000                0032 POLCAT EQU   $A000      CHECK KEYBOARD
                    0033
                    0034 * HARDWARE ADDRESSES
                    0035
FF40                0036 LSBN   EQU   $FF40      EPROM LEAST SIGNIFICANT BYTE
FF41                0037 MSBN   EQU   $FF41      EPROM MOST SIGNIFICANT BYTE
FF42                0038 DATA   EQU   $FF42      EPROM DATA PORT
FF43                0039 CTRL   EQU   $FF43      8255 PPI CONTROL REGISTER
FF44                0040 RONEN  EQU   $FF44      ENABLE EPROM OUTPUT
FF45                0041 PLEN   EQU   $FF45      50 ms EPROM PROGRAMMING PULSE
FF46                0042 VPPEN  EQU   $FF46      EPROM VPP ENABLE
FF47                0043 RST    EQU   $FF47      RESET EPROM PROGRAMMER FLIP-FLOPS,
                    0044
                    0045
                    0047
                    0048
                    0049 * MENU AND MAIN LOOP
                    0050
3000 12             0051 START  NOP
                    0052
3001 CE0600         0053        LDU   #$600      VARIABLE SPACE STARTS AT $600
                    0054
3004 33C81A         0055        LEAX  BUFFER,U   SET UP DEFAULT BUFFER-
3007 AF46           0056        STX   STBUF,U    START LOCATION
3009 10EFC815       0057        STS   STACK,U    SAVE STACK ADDRESS
300D B7FF47         0058 MENU   STA   $FF47      RESET PROGRAMMER
3010 8689           0059        LDA   #$89       MAKE 8255 A, B REG. OUTPUTS
3012 B7FF43         0060        STA   CTRL       MAKE 8255 C REG. AN INPUT PORT
```

Listing continues

William R. Mahoney can be reached at 145 Laureba Ave., Stratford, NJ 08084.

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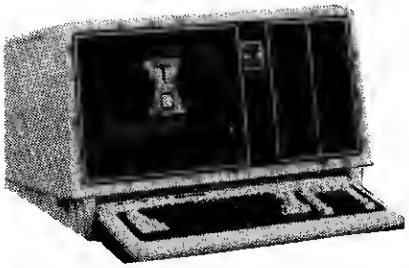

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Listing continued

```
3015 6F4A      0061          CLR   ERR,U       CLR ERROR FLAG
3017 6FC812    0062          CLR   BLNK,U      CLR BLANK ROM FLAG
301A 308D03C4  0063 LOOP     LEAX  MSGA,PCR    GET FIRST MESSAGE FROM TABLE
301E AFC810    0064          STX   MSGPT,U     MESSAGE POINTER
3021 17026C    0065          LBSR  DISPL1      GO PRINT MESSAGE TO SCREEN
3024 170248    0066          LBSR  INPUT       GET KEYBOARD INPUT
3027 8136      0067          CMPA  #$36        IS IT EXIT ?
3029 2716      0068          BEQ   .B1         IF YES,GO QUIT.
302B 308D03A0  0069          LEAX  CMT-3,PCR   SET UP FOR COMMAND JUMP TABLE
302F 3003      0070 .A1      LEAX  3,X         GET COMMAND
3031 6D84      0071          TST   0,X         LAST COMMAND?
3033 27DB      0072          BED   MENU        YES, BAD RESPONSE
3035 A184      0073          CMPA  0,X         MATCH ?
3037 26F6      0074          BNE   .A1         IF NO MATCH
3039 EC01      0075          LDD   1,X         GET OFFSET FOR JUMP
303B 3001      0076          LEAX  1,X         ADJUST X REGISTER FOR JUMP
303D AD8B      0077          JSR   D,X         GO DO IT
303F 20CC      0078          BRA   MENU
3041 39        0079 .B1      RTS
               0080
               0082
               0083 * VERIFY ROM
               0084
3042 6CC812    0085 BLANK    INC   BLNK,U      SET BLANK ROM FLAG
3045 170259    0086          LBSR  ADDR        GET ADDRESSES
3048 308D0027  0087 VERIFY   LEAX  VER1,PCR
304C AFC813    0088 VERB     STX   VERPT,U     SET POINTER FOR INITIAL VERIFY
304F 308D0492  0089          LEAX  MSGG,PCR
3053 AFC810    0090          STX   MSGPT,U     MESSAGE POINTER
3056 170237    0091          LBSR  DISPL1      OUTPUT MESSAGE TO SCREEN
3059 17036C    0092          LBSR  DLY
305C 6F4A      0093          CLR   ERR,U       CLEAR ERROR FLAG
305E ADD813    0094          JSR   [VERPT,U]   CLEAR ERROR FLAG GO DO IT
3061 6D4A      0095          TST   ERR,U       FAILED ?
3063 2601      0096          BNE   .B2        IF YES
3065 39        0097 .A2      RTS
3066 17017E    0098 .B2      LBSR  ERRDSP      SHOW THE FAIL
3069 39        0099          RTS
               0100
306A 6DC812    0101 VER2     TST   BLNK,U      BLANK FLAG SET
306D 2607      0102          BNE   .A3
306F AE48      0103          LDX   CBUF,U      CURRENT BUFFER
3071 2003      0104          BRA   .A3
3073 17014A    0105 VER1     LBSR  INIT        SETUP CADR,X
3076 170133    0106 .A3      LBSR  READ        GET WORD
3079 6DC812    0107          TST   BLNK,U      BLANK FLAG SET
307C 2704      0108          BEQ   .B3         IF NO
307E B1FF      0109          CMPA  #$FF        FOR BLANK
3080 2002      0110          BRA   .C3
3082 A180      0111 .B3      CMPA  ,X+         FOR PROGRAM ROM VERIFY
3084 1026014A  0112 .C3      LBNE  ERROR       IF DIFFERENT, GO PROCESS ERROR
3088 17013E    0113          LBSR  CHECK       LAST ADDR ?
308B 26E9      0114          BNE   .A3         IF NO
308D B7FF47    0115          STA   RST
3090 6FC812    0116          CLR   BLNK,U      RESET BLANK ROM FLAG
3093 39        0117          RTS
               0118
               0119 * LEARN ROM ROUTINE
               0120
3094 17020A    0121 LEARN    LBSR  ADDR        GET ADDRESSES
3097 308D04D7  0122          LEAX  MSGN,PCR
309B AFC810    0123          STX   MSGPT,U     MESSAGE POINTER
309E 1701EF    0124          LBSR  DISPL1
30A1 17011C    0125          LBSR  INIT        SET UP CADR,X
30A4 170105    0126 .A4      LBSR  READ        GET A WORD
30A7 A7B0      0127          STA   ,X+         PUT IT IN BUFFER
30A9 17011D    0128          LBSR  CHECK       LAST ADDRESS ?
30AC 26F6      0129          BNE   .A4         IF NO
30AE B7FF47    0130          STA   RST         ALL DONE.
30B1 39        0131          RTS               AND GO BACK TO MENU
               0132
               0134 * INPUT ROUTINE
               0135
30B2 1701EC    0136 INPUT    LBSR  ADDR
30B5 170108    0137          LBSR  INIT
30B8 AE48      0138          STX   CBUF,U      CURRENT BUFFER
30BA 308D04A1  0139          LEAX  MSGM,PCR
```

```
30BE AFC810    0140          STX   MSGPT,U     MESSAGE POINT
30C1 1701CC    0141          LBSR  DISPL1
30C4 860D      0142 LP       LDA   #$0D
30C6 8D3A      0143          BSR   .B5
30C8 A642      0144          LDA   CADR,U      GET CURRENT-
30CA 8D2C      0145          BSR   .A5         ADDRESSES-
30CC A643      0146          LDA   CADR+1,U    FOR-
30CE 8D28      0147          BSR   .A5         DISPLAY.
30D0 8620      0148          LDA   #$20
30D2 8D2E      0149          BSR   .B5
30D4 AE48      0150          LDX   CBUF,U      GET CURRENT BUFFER ADDRESS
30D6 A684      0151          LDA   ,X          GET THE DATA THAT'S THERE
30D8 8D1E      0152          BSR   .A5         GO PRINT IT
30DA 8620      0153          LDA   #$20        GIVE IT A SPACE
30DC 8D24      0154          BSR   .B5
30DE 170278    0155          LBSR  GETHEX      GET A BYTE FROM KEYBOARD
30E1 6D4A      0156          TST   ERR,U       WAS ERROR FLAG SET ?
30E3 2622      0157          BNE   TEST        IF YES, GO SEE WHY
30E5 A780      0158          STA   ,X+         STORE BYTE IN THE BUFFER
30E7 EC42      0159          LDD   CADR,U      ADVANCE 16 BIT EPROM-
30E9 C30001    0160          ADDD  #$1         CURRENT ADDRESS-
30EC ED42      0161          STD   CADR,U      AND SAVE IT
30EE AF48      0162          STX   CBUF,U      SAVE THE CURRENT BUFFER ADDRESS
30F0 1700D8    0163          LBSR  CHEK        GO SEE IF WE ARE AT STOP ADDRESS
30F3 1026FFCD  0164          LBNE  LP          IF NOT, GO DO ANOTHER ONE
30F7 39        0165          RTS               DEPART.
30F8 17017B    0166 .A5      LBSR  ASC11       CHANGE TO-
30FB 8D05      0167          BSR   .B5         ASCII AND PRINT.
30FD 1E89      0168          EXG   A,B
30FF 8D01      0169          BSR   .B5
3101 39        0170          RTS
3102 AD9FA002  0171 .B5      JSR   [CHROUT]    ---
3106 39        0172          RTS
               0174
               0175 * CONTROL CHARACTER CHECK
               0176
3107 6DC817    0177 TEST     TST   UPFLG,U     IS IT "^" ?
310A 2611      0178          BNE   .B6         IF YES
310C 6DC818    0179          TST   DNFLG,U     DOWN ARROW ?
310F 2624      0180          BNE   .C6         IF YES
3111 6DC819    0181          TST   MFLG,U      IS IT "M" ?
3114 27AE      0182          BEQ   LP          IF NO, THEN IS A BAD RESPONSE
3116 10EEC815  0183          LDS   STACK,U     IT WAS M SO RESTORE
311A 16FEF0    0184          LBRA  MENU        STACK AND LEAVE
311D EC42      0185 .B6      LDD   CADR,U      BACK UP CURRENT -
311F 27A3      0186          BEQ   LP          DON'T BACK UP PAST LOCATION 0
3121 830001    0187          SUBD  #$1         EPROM ADDRESS
3124 ED42      0188          STD   CADR,U      CURRENT ADDRES
3126 EC48      0189          LDD   CBUF,U      BACK UP CURRENT-
3128 830001    0190          SUBD  #$1         BUFFER ADDRESS
312B ED48      0191          STD   CBUF,U      ADDRESS.
312D 170099    0192          LBSR  CHECK       IS IT LAST ADDRESS ?
3130 1026FF90  0193          LBNE  LP          IF NO
3134 39        0194          RTS
3135 EC42      0195 .C6      LDD   CADR,U      ADVANCE CURRENT-
3137 C30001    0196          ADDD  #$1         EPROM ADDRESS
313A ED42      0197          STD   CADR,U
313C EC48      0198          LDD   CBUF,U      ADVANCE CURRENT-
313E C30001    0199          ADDD  #$1         BUFFER ADDRESS
3141 ED48      0200          STD   CBUF,U      ADDRESS.
3143 170083    0201          LBSR  CHECK       IS IT LAST ADDRESS
3146 1026FF7A  0202          LBNE  LP          DO IT AGAIN IF NO
314A 39        0203          RTS
               0204
               0206
               0207 *PROM PROGRAM ROUTINE
               0208
314B 8680      0209 PROG     LDA   #$80        MAKE C REGISTER-
314D B7FF43    0210          STA   CTRL        AN OUTPUT PORT FOR DATA
3150 17014E    0211          LBSR  ADDR        GET ADDRESS
3153 308D0376  0212          LEAX  MSGF,PCR
3157 AFC810    0213          STX   MSGPT,U     MESSAGE POINTER
315A 170133    0214          LBSR  DISPL1
315D B7FF46    0215          STA   VPPEN       TURN ON VPP
3160 8D5E      0216          BSR   INIT        INITIALIZE CADR AND X REGISTER
3162 EC42      0217 .A7      LDD   CADR,U      GET CURRENT ADDRESS
3164 B7FF41    0218          STA   MSBN        OUTPUT ADDRESS TO EPROM-
3167 F7FF40    0219          STB   LSBN        VIA 8255 PORTS A AND B
```

Listing continues

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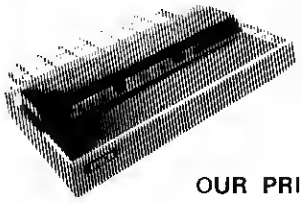

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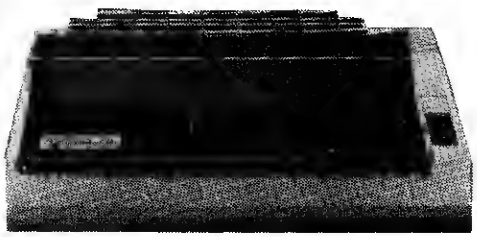

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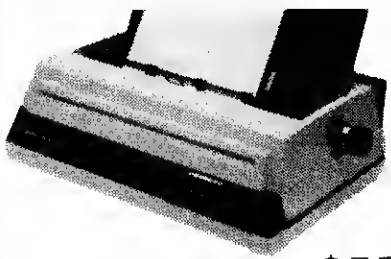

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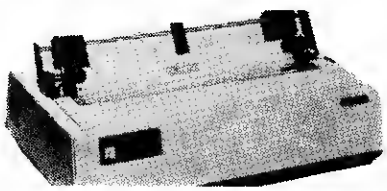

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```
316A C30001     0220        ADDD  #$1         INCR ADDRESS
316D ED42       0221        STD   CADR,U      SAVE NEW CURRENT ADDRESS
316F A680       0222        LDA   ,X+         GET A WORD FROM BUFFER
3171 81FF       0223        CMPA  #$FF        IF IT'S ALL ONES,-
3173 270F       0224        BEQ   .B7         DON'T PROGRAM IT.
3175 B7FF42     0225        STA   DATA        SEND DATA TO EPROM VIA 8255 PORT C
3178 AD9FA000   0226        JSR   [POLCAT]    CHECK THE KEYBOARD
317C 814D       0227        CMPA  #$4D        CHECK FOR BREAK KEY
317E 2713       0228        BEQ   .C7
3180 B7FF45     0229        STA   PLEN        PULSE EPROM
3183 12         0230        NOP               MANDATORY DELAY !!!DON'T DELETE!!!
3184 8D43       0231 .B7    BSR   CHECK       LAST ADDR ?
3186 26DA       0232        BNE   .A7         IF NO
3188 B7FF47     0233        STA   RST
318B 8689       0234        LDA   #$89        PUT 8255 C PORT BACK-
318D B7FF43     0235        STA   CTRL        TO INPUT MODE
3190 17FE85     0236        LBSR  VERIFY      ALL DONE. GO VERIFY EPROM
3193 39         0237 .C7    RTS
                0238
                0240 * MOVE BUFFER ROUTINE
                0241
3194 ECC4       0242 MOVE   LDD   STADR,U     SAVE START-
3196 3406       0243        PSHS  D           ADDRESS.
3198 EC44       0244        LDD   SPADR,U     SAVE STOP-
319A 3406       0245        PSHS  D           ADDRESS.
319C 170102     0246        LBSR  ADDR        GO GET NEW BUFFER START
319F ECC4       0247        LDD   STADR,U     MOVE IT TO BUFFER-
31A1 ED46       0248        STD   STBUF,U     START LOCATION
31A3 3506       0249        PULS  D
31A5 ED44       0250        STD   SPADR,U     RESTORE STOP-
31A7 3506       0251        PULS  D           STOP AND START ADDRESSES
31A9 EDC4       0252        STD   STADR,U
31AB 39         0253        RTS
                0254
                0255 * READ ROUTINE
                0256
31AC B7FF44     0257 READ   STA   ROMEN       ENABLE EPROM
31AF EC42       0258        LDD   CADR,U      GET EPROM ADDRESS
31B1 B7FF41     0259        STA   MSBN        OUTPUT EPROM ADDRESS -
31B4 F7FF40     0260        STB   LSBN        VIA 8255 PORTS A AND B.
31B7 C30001     0261        ADDD  #$1         INCREMENT
31BA ED42       0262        STD   CADR,U      CURRENT ADDRESS
31BC B6FF42     0263        LDA   DATA        READ EPROM VIA 8255 C PORT
31BF 39         0264        RTS
                0265
                0266 * X REG AND CADR INITIALIZATION
                0267 * AND CURRENT BUFFER SAVE
                0268
31C0 ECC4       0269 INIT   LDD   STADR,U     SET CURRENT ADDRESS-
31C2 ED42       0270        STD   CADR,U      EQUAL TO START ADDRESS
31C4 E346       0271        ADDD  STBUF,U     SET BUFFER START POINTER TO-
31C6 1F01       0272        TFR   D,X         CORRESPOND TO EPROM START ADDRESS
31C8 39         0273        RTS
                0274
                0275 * MAX ADDRESS CHECK ROUTINE
                0276
31C9 EC42       0277 CHECK  LDD   CADR,U      EPROM CURRENT ADDRESS
31CB B30001     0278 CHEK   SUBD  #$1
31CE 10A344     0279        CMPD  SPADR,U     EPROM STOP ADDRESS
31D1 39         0280        RTS
                0281
                0282 * ERROR PROCESSING ROUTINE
                0283
31D2 A74D       0284 ERROR  STA   FLDAT,U     FAIL DATA
31D4 EC42       0285        LDD   CADR,U      GET CURRENT ADDRESS AND-
31D6 830001     0286        SUBD  #$1         ADJUST IT, AND PUT IT-
31D9 ED4B       0287        STD   FLADR,U     IN FAIL ADDRESS LOCATION
31DB 6C4A       0288        INC   ERR,U       SET ERROR FLAG
31DD AF48       0289        STX   CBUF,U      SAVE BUFFER ADDRESS
31DF A682       0290        LDA   ,-X         GET EXPECTED DATA AND STORE IT-
31E1 A74E       0291        STA   EXDTA,U     IN EXPECTED DATA LOCATION
31E3 B7FF47     0292        STA   RST         RESET EPROM PROGRAMMER FLIP-FLOPS
31E6 39         0293        RTS
                0294
                0296 * DISPLAY ERROR DATA
                0297
31E7 308D0311   0298 ERRDSP LEAX  MSGH,PCR
31EB AFC810     0299        STX   MSGPT,U     MESSAGE POINTER
31EE 17009F     0300        LBSR  DISPL1
31F1 308D0315   0301        LEAX  MSG1,PCR
31F5 AFC810     0302        STX   MSGPT,U     MESSAGE POINTER
31F8 170098     0303        LBSR  DISPL2
31FB A64B       0304        LDA   FLADR,U     DISPLAYS FAIL ADDRESS MSB
31FD BD52       0305        BSR   .E8
31FF A64C       0306        LDA   FLADR+1,U   DISPLAYS FAIL ADDRESS LSB
3201 BD4E       0307        BSR   .E8
3203 308D0315   0308        LEAX  MSGJ,PCR
3207 AFC810     0309        STX   MSGPT,U     MESSAGE POINTER
320A 170086     0310        LBSR  DISPL2
320D A64D       0311        LDA   FLDAT,U     DISPLAYS FAIL DATA
320F BD40       0312        BSR   .E8
3211 308D0317   0313        LEAX  MSGK,PCR
3215 AFC810     0314        STX   MSGPT,U     MESSAGE POINTER
3218 170078     0315        LBSR  DISPL2
321B 6DCB12     0316        TST   BLNK,U      IS BLANK FLAG SET ?
321E 2604       0317        BNE   .A8         IF YES,  EXPECTED DATA IS $FF
3220 A64E       0318        LDA   EXDTA,U     EXPECTED DATA FOR PROGRAMMED EPROM
3222 2002       0319        BRA   .B8
3224 86FF       0320 .A8    LDA   #$FF        FOR BLANK ROM
3226 8D29       0321 .B8    BSR   .E8
3228 308D0314   0322        LEAX  MSGL,PCR
322C AFC810     0323        STX   MSGPT,U     MESSAGE POINTER
322F 170061     0324        LBSR  DISPL2
3232 17003A     0325        LBSR  KINPUT      GET RESPONSE
3235 814E       0326        CMPA  #$4E        IS IT "N" ?
3237 2712       0327        BEQ   .C8         IF YES, BAIL OUT
3239 8159       0328        CMPA  #$59        IS IT "Y" ?
323B 2702       0329        BEQ   CONT        IF YES, CONTINUE VERIFY
323D 20A8       0330        BRA   ERRDSP      MUST BE A BAD ANSWER
323F 17FF87     0331 CONT   LBSR  CHECK       HAVE WE REACHED STOP ADDRESS ?
3242 2707       0332        BEQ   .C8         IF YES, BAIL OUT
3244 308DFE22   0333        LEAX  VER2,PCR    SET UP VERIFY POINTER FOR-
3248 16FE01     0334        LBRA  VERB
324B 6FC812     0335 .C8    CLR   BLNK,U      RESET BLANK FLAG
324E 6F4A       0336        CLR   ERR,U       RESET ERROR FLAG
3250 39         0337        RTS
3251 170022     0338 .E8    LBSR  ASCII       GO CHANGE HEX BYTES TO ASCII
3254 AD9FA002   0339        JSR   [CHROUT]    OUTPUT FIRST BYTE TO SCREEN
3258 1E89       0340        EXG   A,B
325A AD9FA002   0341        JSR   [CHROUT]    OUTPUT SECOND BYTE TO SCREEN
325E 39         0342        RTS
                0343
                0345 * CHARACTER OUTPUT ROUTINE
                0346
325F 109F88     0347 OUTPUT STY   CURSOR      ACTS LIKE A 'PRINT@' STATEMENT
3262 A680       0348 .A9    LDA   ,X+         GET A CHARACTER FROM MESSAGE TABLE
3264 8100       0349        CMPA  #$00        IS IT END OF STRING ?
3266 2706       0350        BEQ   .B9         IF YES, GO HOME
3268 AD9FA002   0351        JSR   [CHROUT]    DO IT AGAIN
326C 20F4       0352        BRA   .A9         DO IT AGAIN
326E 39         0353 .B9    RTS
                0354
                0355 * INPUT CHARACTER ROUTINE
                0356
326F AD9FA000   0357 KINPUT JSR   [POLCAT]    HAS A KEY BEEN PRESSED ?
3273 27FA       0358        BEQ   KINPUT      KEEP LOOKING TILL KEY IS PRESSED
3275 39         0359        RTS
                0360
                0361 * HEX TO ASCII ROUTINE
                0362
3276 1F89       0363 ASCII  TFR   A,B         DON'T WANT TO LOSE SECOND NIBBLE
3278 47         0364        ASRA
3279 47         0365        ASRA              RIGHT JUSTIFY IT
327A 47         0366        ASRA
327B 47         0367        ASRA
327C 8D07       0368        BSR   .A10        GO CONVERT FIRST NIBBLE
327E 1E89       0369        EXG   A,B         RETRIEVE ORIGINAL BYTE, SAVE ASCII
3280 8D03       0370        BSR   .A10        GO CONVERT SECOND NIBBLE
3282 1E89       0371        EXG   A,B         PUT ASCII BYTES IN CORRECT ORDER
3284 39         0372        RTS
3285 840F       0373 .A10   ANDA  #$F         CLEAR UPPER NIBBLE
3287 8B30       0374        ADDA  #$30        PUT IT IN THE ASCII RANGE
3289 8139       0375        CMPA  #$39        IS IT A NUMBER ?
328B 2F02       0376        BLE   .B10        IF YES
328D 8B07       0377        ADDA  #$7         NO, MAKE IT AN ALPHA CHARACTER
328F 39         0378 .B10   RTS
                0379
```

Listing continues

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```
                    0380 * DISPLAY MSG   ROUTINE
                    0381
3290 BDA928         0382 DISPL1 JSR   CLS
3293 30D810         0383 DISPL2 LEAx  [MSGPT,U]   POINT TO THE DESIRED MESSAGE
3296 10AE81         0384 .A11   LDY   .X++        SET UP THE SCREEN LOCATION POINTER
3299 2705           0385        BEQ   .B11        IF IT'S AT END OF MESSAGE
329B 17FFC1         0386        LBSR  OUTPUT      GO PRINT THE STRING
329E 20F6           0387        BRA   .A11        GO PRINT THE NEXT STRING
32A0 39             0388 .B11   RTS
                    0389
                    0391 * ADDRESS ROUTINE
                    0392
32A1 BDA928         0393 ADDR   JSR   CLS
32A4 30BD01AB       0394 STMSG  LEAX  MSGB,PCR    ASK FOR START ADDRESS
32A8 AFC810         0395        STX   MSGPT,U     MESSAGE POINTER
32AB 17FFE5         0396        LBSR  DISPL2
32AE 6F4A           0397        CLR   ERR,U       RESET ERROR FLAG
32B0 1700A6         0398        LBSR  GETHEX      GET BYTE
32B3 6D4A           0399        TST   ERR,U       IS ERROR FLAG SET ?
32B5 260D           0400        BNE   .A12        IF YES,  GO SEE WHY
32B7 A7C4           0401        STA   STADR,U     START ADDRESS (MSB)
32B9 17009D         0402        LBSR  GETHEX      GET SECOND BYTE
32BC 6D4A           0403        TST   ERR,U       IS ERROR FLAG SET ?
32BE 2604           0404        BNE   .A12        IF YES, GO SEE WHY
32C0 A741           0405        STA   STADR+1,U   START ADDRESS (LSB)
32C2 2016           0406        BRA   SPMSG       ASK FOR STOP ADDRESS
                    0407
32C4 6DC817         0408 .A12   TST   UPFLG,U     IS IT "^" ?
32C7 26D8           0409        BNE   ADDR        IF YES.ASK FOR START ADDRESS AGAIN
32C9 6DC818         0410        TST   DNFLG,U     <ENTER> OR DOWN ARROW ?
32CC 260C           0411        BNE   SPMSG       IF YES,DEFAULT START,AND GET STOP
32CE 6DC819         0412        TST   MFLG,U      IS IT "M" ?
32D1 27CE           0413        BEQ   ADDR        IF NO, THEN IT WAS A BAD RESPONSE
32D3 10EEC815       0414        LDS   STACK,U     RESET STACK POINTER
32D7 16FD33         0415        LBRA  MENU
                    0416
32DA 30BD01AE       0417 SPMSG  LEAX  MSGC,PCR    ASK FOR STOP ADDRESS
32DE AFC810         0418        STX   MSGPT,U     MESSAGE POINTER
32E1 17FFAF         0419        LBSR  DISPL2
32E4 6F4A           0420        CLR   ERR,U       RESET ERROR FLAG
32E6 170070         0421        LBSR  GETHEX      GET BYTE
32E9 6D4A           0422        TST   ERR,U       ERROR FLAG SET?
32EB 260D           0423        BNE   .A13        IF YES, GO SEE WHY
32ED A744           0424        STA   SPADR,U     STORE STOP ADDRESS MSB
32EF 170067         0425        LBSR  GETHEX      GET SECOND BYTE
32F2 6D4A           0426        TST   ERR,U       ERROR FLAG SET?
32F4 2604           0427        BNE   .A13        IF YES GO SEE WHY
32F6 A745           0428        STA   SPADR+1,U   STOP ADDRESS (LSB)
32F8 2023           0429        BRA   CHNG        DO YOU WANT TO CHANGE ADDRESSES
                    0430
32FA 6DC817         0431 .A13   TST   UPFLG,U     IS IT "^" ?
32FD 270B           0432        BEQ   .B13        IF NO
32FF CC6060         0433 .D13   LDD   #$6060      ERASE STOP-
3302 FD04C1         0434        STD   $4C1        ADDRESS -
3305 FD04C3         0435        STD   $4C3        ON SCREEN
3308 20D0           0436        BRA   SPMSG
330A 6DCB18         0437 .B13   TST   DNFLG,U     IS IT DOWN ARROW ?
330D 260E           0438        BNE   CHNG        IF YES
330F 6DCB19         0439        TST   MFLG,U      IS IT "M" ?
3312 2707           0440        BEQ   .C13        IF NO
3314 10EEC815       0441 HOME   LDS   STACK,U     RESET STACK POINTER
3318 16FCF2         0442        LBRA  MENU
331B 20E2           0443 .C13   BRA   .D13        BAD RESPONSE
                    0445
                    0446 * CHANGE ADDRESS ROUTINE
                    0447
331D ECC4           0448 CHNG   LDD   STADR,U     START ADDRESS
331F 10A344         0449        CMPD  SPADR,U     STOP ADDRESS
3322 221C           0450        BHI   .A14        IF START > STOP, IT'S NO GOOD
3324 30BD0185       0451        LEAX  MSGD,PCR
3328 AFC810         0452        STX   MSGPT,U     MESSAGE POINTER
332B 17FF65         0453        LBSR  DISPL2
332E 17FF3E         0454        LBSR  KINPUT      GET RESPONSE
3331 814D           0455        CMPA  #$4D        IS IT "M"
3333 27DF           0456        BEQ   HOME        IF YES
3335 8159           0457        CMPA  #$59        IS IT "Y" ?
3337 1027FF66       045B        LBEQ  ADDR
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333B 814E           0459        CMPA  #$4E        IS IT "N" ?
333D 26DE           0460        BNE   CHNG        BAD RESPONSE
333F 39             0461        RTS
3340 30BD023B       0462 .A14   LEAX  MSGO,PCR
3344 AFC810         0463        STX   MSGPT,U     MESSAGE POINTER
3347 17FF46         0464        LBSR  DISPL1      TELL THEM THE ADDRESSES NO GOOD
334A 3402           0465        PSHS  A
334C 86FF           0466        LDA   #$FF
334E 170077         0467 .B14   LBSR  DLY
3351 4A             0468        DECA
3352 26FA           0469        BNE   .B14
3354 3502           0470        PULS  A
3356 16FF48         0471        LBRA  ADDR
                    0472
                    0473 * ROUTINE TO TAKE ASCII INPUT
                    0474 * AND CONVERT TO HEX BYTES
                    0475
3359 17FF13         0476 GETHEX LBSR  KINPUT      GET KEYBOARD INPUT
335C 170021         0477        LBSR  HEXCHK      MAKE IT HEX AND CHECK FOR ERROR
335F 6D4A           0478        TST   ERR,U       ERROR FLAG SET ?
3361 261C           0479        BNE   .C15        WASN'T  HEX. GET OUT
3363 AD9FA002       0480 .A15   JSR   [CHROUT]    ECHO ASCII CHARACTER
3367 58             0481        ASLB
3368 58             0482        ASLB              SHIFT NIBBLE
3369 58             0483        ASLB              LEFT
336A 58             0484        ASLB
336B E74F           0485        STB   TEMP,U      SAVE THE ASCII BYTE
336D 17FEFF         0486 .B15   LBSR  KINPUT      GET OTHER ONE
3370 17000D         0487        LBSR  HEXCHK      CONVERT IT
3373 6D4A           0488        TST   ERR,U       ERROR FLAG SET ?
3375 2608           0489        BNE   .C15        IF YES, LEAVE
3377 AD9FA002       0490        JSR   [CHROUT]    GO ECHO THE CHARACTER
337B EB4F           0491        ADDB  TEMP,U      COMBINE IT WITH THE OTHER NIBBLE
337D 1F98           0492        TFR   B,A         PUT IN PROPER ORDER
337F 39             0493 .C15   RTS
                    0494
                    0496 * HEXCHK USED TO CHECK INPUT
                    0497 * FOR VALID HEX INPUT
                    0498
3380 6F4A           0499 HEXCHK CLR   ERR,U       RESET ERROR FLAG
3382 6FC817         0500        CLR   UPFLG,U     RESET "^" FLAG
3385 6FC818         0501        CLR   DNFLG,U     RESET DOWN FLAG
3388 6FC819         0502        CLR   MFLG,U      RESET MENU FLAG
338B 1F89           0503        TFR   A,B         SAVE ASCII FOR LATER USE
338D C030           0504        SUBB  #$30        MAKE IT BINARY
338F 2D0F           0505        BLT   .B16        IF IT'S LESS THAN "0"
3391 C109           0506        CMPB  #$9         IF IT'S BETWEEN 0 AND 9, IT'S GOOD
3393 2F0A           0507        BLE   .A16        LEAVE
3395 C007           0508        SUBB  #$7         PUT IT IN ALPHABET RANGE
3397 C10A           0509        CMPB  #$A         IS IT BETWEEN $A AND $B ?
3399 2D05           0510        BLT   .B16        IT'S NOT ASCII
339B C10F           0511        CMPB  #$F
339D 2E01           0512        BGT   .B16        IT'S NOT ASCII
339F 39             0513 .A16   RTS
33A0 6C4A           0514 .B16   INC   ERR,U       SET ERROR FLAG
33A2 8D01           0515        BSR   CNTRL       IS IT A CONTROL CHARACTER ?
33A4 39             0516        RTS
                    0517
                    0518 * CONTROL CHARACTER CHECK
                    0519
33A5 815E           0520 CNTRL  CMPA  #$5E        IS IT "^" ?
33A7 2605           0521        BNE   .A17        IF NO
33A9 6CC817         0522        INC   UPFLG,U     SET "^" FLAG
33AC 2019           0523        BRA   .D17
33AE 810A           0524 .A17   CMPA  #$A         IS IT DOWN ARROW
33B0 2605           0525        BNE   .B17        IF NO
33B2 6CC818         0526        INC   DNFLG,U     SET DOWN FLAG
33B5 2010           0527        BRA   .D17
33B7 810D           0528 .B17   CMPA  #$0D        IS IT <ENTER>
33B9 2605           0529        BNE   .C17        IF NO
33BB 6CC818         0530        INC   DNFLG,U     SET DOWN FLAG
33BE 2007           0531        BRA   .D17
33C0 814D           0532 .C17   CMPA  #$4D        IS IT "M" ?
33C2 2603           0533        BNE   .D17        IF NO
33C4 6CC819         0534        INC   MFLG,U      SET MENU FLAG
33C7 39             0535 .D17   RTS
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Listing continues

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                    0536
                    0537 * DELAY ROUTINE
                    0538
33C8 3402           0539 DLY    PSHS  A
33CA 86FF           0540        LDA   #$FF
33CC 4A             0541 .A18   DECA
33CD 26FD           0542        BNE   .A18
33CF 3502           0543        PULS  A
33D1 39             0544        RTS
                    0545
                    0547 * COMMAND/JUMP TABLE
                    0548
33D2 31             0549 CMT    FCC   /1
33D3 FC&F           0550        FDB   BLANK-*
33D5 32             0551        FCC   /2
33D6 FCBE           0552        FDB   LEARN-*
33D8 33             0553        FCC   /3
33D9 FCD9           0554        FDB   INPUT-*
33DB 34             0555        FCC   /4
33DC FD6F           0556        FDB   PROG-*
33DE 35             0557        FCC   /5
33DF FDB5           0558        FDB   MOVE-*
33E1 00             0559        FCB   0
                    0560
                    0561 *MESSAGE TABLES
                    0562
33E2 0486           0563 MSGA   FDB   $4B6
33E4 31             0564        FCC   /1.VERIFY BLANK ROM/
33E5 2E56455249
33EA 465920424C
33EF 414E4B2052
33F4 4F4D
33F6 00             0565        FCB   0
33F7 04A6           0566        FDB   $4A6
33F9 32             0567        FCC   /2.LEARN ROM/
33FA 2E4C454152
33FF 4E20524F4D
3404 00             0568        FCB   0
3405 04C6           0569        FDB   $4C6
3407 33             0570        FCC   /3.INPUT DATA/
3408 2E494E5055
340D 5420444154
3412 41
3413 00             0571        FCB   0
3414 04E6           0572        FDB   $4E6
3416 34             0573        FCC   /4.PROGRAM ROM/
3417 2E50524F47
341C 52414D2052
3421 4F4D
3423 00             0574        FCB   0
3424 0506           0575        FDB   $506
3426 35             0576        FCC   /5.MOVE BUFFER/
3427 2E4D4F5645
342C 2042554646
3431 4552
3433 00             0577        FCB   0
3434 0526           0578        FDB   $526
3436 36             0579        FCC   /6.EXIT/
3437 2E45584954
343C 00             0580        FCB   0
343D 0566           0581        FDB   $566
343F 54             0582        FCC   /TYPE SELECTION/
3440 5950452053
3445 454C454354
344A 494F4E
344D 00             0583        FCB   0
344E 0000           0584        FDB   0
                    0585
3450 0403           0586 MSGB   FDB   $403
3452 54             0587        FCC   /TYPE START ADDRESS /
3453 5950452053
3458 5441525420
345D 4144445245
3462 535320
3465 49             0588        FCC   /IN HEX/
3466 4E204B4558
346B 00             0589        FCB   0
346C 0444           0590        FDB   $444
346E 54             0591        FCC   /TYPE <ENTER> TO /
346F 595045203C
3474 454E544552
```

```
3479 3E20544F20
347E 44             0592        FCC   /DEFAULT/
347F 454641554C
3484 54
3485 00             0593        FCB   0
3486 0460           0594        FDB   $460
3488 3E             0595        FCC   />/
3489 00             0596        FCB   0
348A 0000           0597        FDB   0
                    0598
348C 04A3           0599 MSGC   FDB   $4A3
348E 54             0600        FCC   /TYPE STOP ADDRESS /
348F 5950452053
3494 544F502041
3499 4444524553
349E 5320
34A0 49             0601        FCC   /IN HEX/
34A1 4E204B4558
34A6 00             0602        FCB   0
34A7 04C0           0603        FDB   $4C0
34A9 3E             0604        FCC   />/
34AA 00             0605        FCB   0
34AB 0000           0606        FDB   0
                    0607
34AD 0543           0608 MSGD   FDB   $543
34AF 43             0609        FCC   /CHANGE ADDRESSES /
34B0 4B414E4745
34B5 2041444452
34BA 4553534553
34BF 20
34C0 3F             0610        FCC   /? (Y OR N)/
34C1 2028592046
34C6 52204E29
34CA 00             0611        FCB   0
34CB 0000           0612        FDB   0
                    0613
                    0614
34CD 04A7           0615 MSGF   FDB   $4A7
34CF 50             0616        FCC   /PROGRAM IN PROGRESS/
34D0 524F475241
34D5 4D204946E20
34DA 50524F4752
34DF 455353
34E2 00             0617        FCB   0
34E3 0000           0618        FDB   0
                    0619
34E5 04A7           0620 MSGG   FDB   $4A7
34E7 56             0621        FCC   /VERIFY IN PROGRESS/
34E8 4552494659
34ED 20494E2050
34F2 524F475245
34F7 5353
34F9 00             0622        FCB   0
34FA 0000           0623        FDB   0
                    0624
34FC 044A           0625 MSGH   FDB   $44A
34FE 52             0626        FCC   /ROM ERROR/
34FF 4F4D204552
3504 524F52
3507 00             0627        FCB   0
3508 0000           0628        FDB   0
350A 04A6           0629 MSGI   FDB   $4A6
350C 52             0630        FCC   /ROM ADDRESS  /
350D 4F4D204144
3512 4452455353
3517 2020
3519 00             0631        FCB   0
351A 0000           0632        FDB   0
351C 04C6           0633 MSGJ   FDB   $4C6
351E 46             0634        FCC   /FAIL DATA  /
351F 41494C2044
3524 4154412020
3529 00             0635        FCB   0
352A 0000           0636        FDB   0
352C 04E6           0637 MSGK   FDB   $4E6
352E 45             0638        FCC   /EXPECTED DATA  /
352F 5850454354
3534 4544204441
3539 5441202F
```

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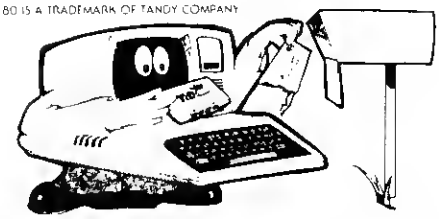

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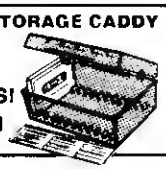

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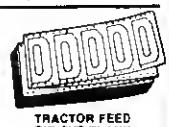

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```
353D 00          0639          FCB   0
353E 0000        0640          FDB   0
3540 0506        0641 MSGL     FDB   $506
3542 43          0642          FCC   /CONTINUE VERIFY ? /
3543 4F4E54494E
354B 5545205645
354D 5249465920
3552 3F20
3554 28          0643          FCC   /(Y OR N)/
3555 59204F5220
355A 4E29
355C 00          0644          FCB   0
355D 0000        0645          FDB   0
355F 0400        0646 MSGM     FDB   $400
3561 49          0647          FCC   /INPUT HEX DATA/
3562 4E50555420
3567 4845582044
356C 415441
356F 00          0648          FCB   0
3570 0000        0649          FDB   0
3572 044A        0650 MSGN     FDB   $44A
3574 4C          0651          FCC   /LEARNING/
3575 4541524E49
357A 4E47
357C 00          0652          FCB   0
357D 0000        0653          FDB   0
357F 044C        0654 MSGO     FDB   $44C
3581 45          0655          FCC   /ERROR/
3582 52524F52
3586 00          0656          FCB   0
3587 04B4        0657          FDB   $4B4
3589 53          0658          FCC   /START ADDRESS IS /
358A 5441525420
358F 4144445245
3594 5353204953
3599 20
359A 48          0659          FCC   /HIGHER/
359B 4947484552
35A0 00          0660          FCB   0
35A1 04C7        0661          FDB   $4C7
35A3 54          0662          FCC   /THAN STOP ADDRESS/
35A4 4841 4E2053
35A9 544F502041
35AE 4444524553
35B3 53
35B4 00          0663          FCB   0
35B5 0000        0664          FDB   0
                 0665
35B7             0666 LAST     EQU   *
                 0667
3000             0668          END   START
        NO ERROR(S) DETECTED
```

SYMBOL TABLE:

```
.A1     302F    .A10    3285    .A11    3296    .A12    32C4
.A13    32FA    .A14    3340    .A15    3363    .A16    339F
.A17    33AE    .A18    33CC    .A2     3065    .A3     3076
.A4     30A4    .A5     30FB    .A7     3162    .A8     3224
.A9     3262    .B1     3041    .B10    32BF    .B11    32A0
.B13    330A    .B14    334E    .B15    336D    .B16    33A0
.B17    33B7    .B2     3066    .B3     30B2    .B5     3102
.B6     311D    .B7     3184    .B8     3226    .B9     326E
.C13    331B    .C15    337F    .C17    33C0    .C3     3084
.C6     3135    .C7     3193    .C8     324B    .D13    32FF
.D17    33C7    .E8     3251    ADDR    32A1    ASC11   3276
BLANK   3042    BLNK    0012    BUFFER  001A    CADR    0002
CBUF    0008    CHECK   31C9    CHEK    31CB    CHNG    331D
CHROUT  A002    CLS     A92B    CMT     33D2    CNTRL   33A5
CONT    323F    CTRL    FF43    CURSOR  0088    DATA    FF42
DISPL1  3290    DISPL2  3293    DLY     33CB    DNFLG   001B
ERR     000A    ERRDSP  31E7    ERROR   31D2    EXDTA   000E
FLADR   000B    FLDAT   000D    GETHEX  3359    HEXCHK  33B0
HOME    3314    INIT    31C0    INPUT   30B2    KINPUT  326F
LAST    35B7    LEARN   3094    LOOP    301A    LP      30C4
```

```
STMSG   32A4    TEMP    000F    TEST    3107    UPFLG   0017
VER1    3073    VER2    306A    VERB    304C    VERIFY  3048
VERPT   0013    VPPEN   FF46    WARS    0000
LSBN    FF40    MENU    300D    MFLG    0019    MOVE    3194
MSBN    FF41    MSGA    33E2    MSGB    3450    MSGC    348C
MSGD    34AD    MSGF    34CD    MSGG    34E5    MSGH    34FC
MSG1    350A    MSGJ    351C    MSGK    352C    MSGL    3540
MSGM    355F    MSGN    3572    MSGO    357F    MSGPT   0010
OUTPUT  325F    PLEN    FF45    POLCAT  A000    PROG    3148
READ    31AC    ROMEN   FF44    RST     FF47    SPADR   0004
SPMSG   32DA    STACK   0015    STADR   0000    START   3000
```

Program Listing 2

```
                 0001
                 0002          NAM   AIDS LISTING 2
4000             0003          ORG   $4000
                 0004
                 0005 * BY WILLIAM R. MAHONEY
                 0006
                 0007 * ROUTINES TO AID IN TROUBLESHOOTING THE CoCo EPROM
                 0008 * PROGRAMMER. EACH ROUTINE IS A CONTINUOUS LOOP, AND CAN BE
                 0009 * USED TO CHECK ONE OR MORE FUNCTIONS WITH A SCOPE.
                 0010
                 0011
                 0012 * THIS ROUTINE WILL CHECK IC'S A3, B2, B3 (SECTIONS C-D),
                 0013 * A2, AND A81. LINE 19 WRITES TO THE PPI CONTROL REGISTER
                 0014 * WHILE LINE 17 WRITES TO A PORT. $FF40=PORT A.
                 0015 * $FF41=PORT B, AND $FF42=PORT C.
                 0016
4000 8680        0017 START    LDA   #$80          PROGRAMS PPI FOR 3
4002 B7FF43      0018          STA   $FF43         OUTPUT PORTS
4005 B7FF40      0019 .A1      STA   $FF40         WRITES TO PORT A
4008 20FB        0020          BRA   .A1           CONTINUOUS LOOP ON WRITE.
                 0021
                 0022
                 0023 * THIS ROUTINE CHECKS THE SAME COMPONENTS AS ABOVE, BUT
                 0024 * DOES A CONTINUOUS READ OF THE PPI PORT C
                 0025 * LINE 29 PROGRAMS THE PPI PORTS A AND B AS OUTPUTS AND
                 0026 * PORT C AS AN INPUT
                 0027
400A 8689        0028          LDA   #$89          PROGRAM PPI FOR PORTS A AND B OUT-
400C B7FF43      0029          STA   $FF43         PUT AND PORT C FOR INPUT
400F B6FF42      0030 .A2      LDA   $FF42         READS PORT C
4012 20FB        0031          BRA   .A2           CONTINUOUS READ
                 0032
                 0033
                 0034 * THIS ROUTINE CHECKS IC'S A3, B2, B3, E3, C3, D1, D2
                 0035 * AND ASSOCIATED CIRCUITRY. IN EACH CASE, THE DATA SENT
                 0036 * FROM ACCUMULATOR A DOESN'T MATTER AS ONLY THE ADDRESS IS
                 0037 * SIGNIFICANT. EACH FLIP-FLOP CAN BE SELECTED BY CHANGING
                 0038 * THE ADDRESS WRITTEN TO IN LINE 42.
                 0039 * ROMEN*=$FF44, PLEN*=$FF45, VPPEN*=$FF46, AND RST*=$FF47
                 0040
                 0041
4014 B7FF44      0042 .A3      STA   $FF44         SET ROMEN FLIP-FLOP
4017 12          0043          NOP
4018 B7FF47      0044          STA   $FF47         RESET PROGRAMMER
401B 20F7        0045          BRA   .A3           CONTINUOUS LOOP ON SET AND RESET
                 0046
4000             0047          END   START
        NO ERROR(S) DETECTED
```

SYMBOL TABLE:

```
.A1     4005    .A2     400F    .A3     4014    NARG    0000
```

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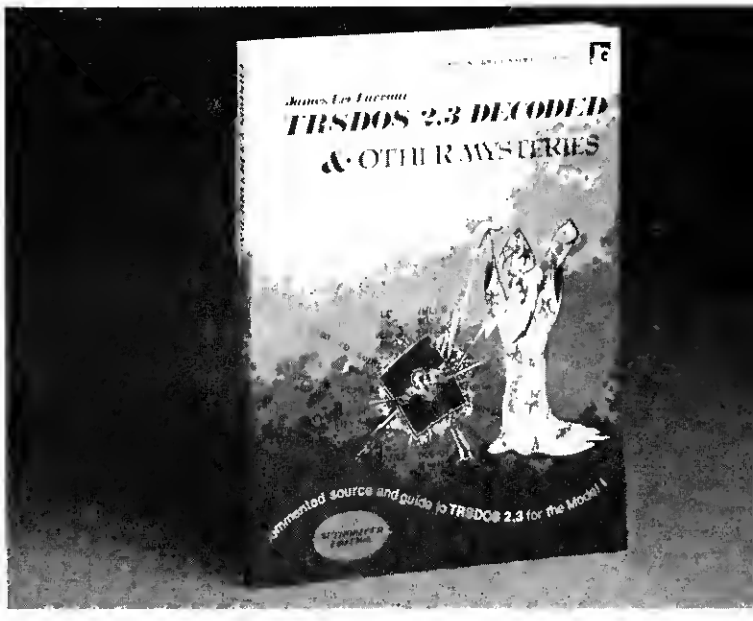

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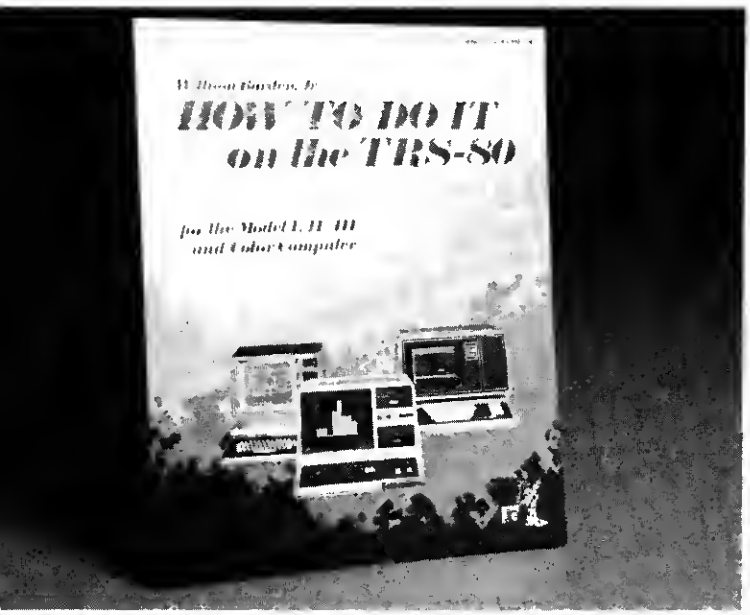

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Matchless Systems	600	I, III	5¼"	250
	627	Same	Same	Same
	650	II, 12, 16	8"	600
	654	Same	Same	Same
Microcomputer Technology	350 TF 11	I	5¼"	174
	1470 140-1	III	Same	175
	1471 140-2	Same	Same	Same
	1473 140-3 & 140-4	Same	Same	Same
Percom Data Corp. Inc.	TFD40-1	I	5¼"	184
	TFD40-2	Same	Same	Same
	TFD340-N1	III	Same	Same
	TFD340-N2	Same	Same	Same
	ADD340-N1	Same	Same	Same
	ADD340-X1	Same	Same	Same
	ADD340-X2	Same	Same	Same
PMC Inc.	SFD-51A	I, III	5¼"	250
Radio Shack/Tandy Corp.	261161	I	5¼"	350
	264160	II	8" (76-track)	486
	261164	III	5¼" DS, DD	175
	263023	CC	5¼" (35-track)	156
VR Data Corp.	100-1	III	5¼"	175

NA—Not Available
SS—Single-Sided
DS—Double-Sided
SD—Single-Density

For years now you have been saving your pennies in a coffee can, sacrificing the good things in life, and you're finally ready to visit the local computer store to buy a hard or floppy disk drive. To your dismay, you discover a variety of disk drives for your computer.

Before you tear at your micro in despair, take a look at this buyer's guide. We've taken the frustration out of selecting a disk drive for you. We've included information on both hard disk drives and floppy drives (for those of you who have only a half-full can of pennies). We've also listed information on floppy disks.

Floppy Disk Drives

We haven't forgotten you Model I owners or those of you considering another floppy disk drive for your system. Unless otherwise noted in the chart, all the floppy disk drives listed are 40-track, single-sided, double-density drives. This is the most common add-on unit on the market today, and the one that most of you purchase.

We omitted original equipment manufacturers (OEMs) from this listing since they provide drives and parts for virtually hundreds of different hard and floppy disk drive system .

When you look over the floppy guide, you'll notice that there is a wide range in the disk capacity for these drives (160–600 kilobytes). So if you need a specific capacity for your up-

Continues on p. 238

FLOPPY DISK DRIVE MANUFACTURERS

Interface Inc.
7630 Alabama Ave.
Canoga Park, CA 91304
213-341-7914

Matchless Systems
18444 S. Broadway
Gardena, CA 90248
213-327-1010

Microcomputer Technology Inc.
1530 S. Sinclair St.
Anaheim, CA 92806
714-978-9833

Percom Data Corp., Inc.
11220 Pagemill Road
Dallas, TX 75243
214-340-7081

Personal Microcomputer Inc.
475 Ellis St.
Mountain View, CA 94043
415-962-0220

Radio Shack/Tandy Corp.
One Tandy Center
Fort Worth, TX 76102
817-390-3011

VR Data
777 Henderson Blvd. N-6
Folcraft, PA 19032
800-345-8102

Avg. Access Time (ms)	Track→Track Access Time (ms)	Data Transfer Rate (K bits/s)	Warranty	Price
75	5	250	90 days P/L	$235
75	5	NA	90 days P/L	$399.95 (1 drive)
Same	Same	Same	Same	$686 (2 drives)
NA	3	500	Same	$745 (1 drive)
Same	Same	Same	Same	$1260 (2 drives)
NA	6	NA	90 days P/L	$299
Same	Same	Same	Same	$499 (1 drive)
Same	Same	Same	Same	$239 (2 drives)
Same	Same	Same	Same	$299 (3 or 4 drives)
NA	5	250	90 days P/L	$399 (1 drive)
Same	Same	Same	Same	$789 (2 drives)
Same	Same	Same	Same	$579 (1 internal drive)
Same	Same	Same	Same	$959 (2 internal drives)
Same	Same	Same	Same	$399 (1 add-on drive)
Same	Same	Same	Same	$419 (1 add-on external)
Same	Same	Same	Same	$829 (2 add-on externals)
100	5	250	9 months P/L	$355
NA	5	500	90 days P/L	$499 (2nd drive)
Same	Same	Same	Same	$1150 (incl. cabinet)
Same	Same	Same	Same	$449 (3rd drive)
Same	Same	Same	Same	$399 (2nd drive)
90	5	250	120 days P/L	$864

DD—Double-Density
P/L—Parts and Labor
Y—Yes
N—No
F—Fixed
R—Removable

HARD DISK DRIVES

Company		For Use With Model	Data Capacity (Megabytes)	Disk Size	Operating System
A. M. Electronics Inc.	RD-5067	III	6.7 F (unformatted)	5¼"	DOSPLUS 4.0
	RD-5133	Same	13.3 F (unformatted)	Same	Same
A. R. Business Systems	ARM 525	I, II, III 12, 16	5 F	5¼"	I/III: LDOS II, 12, 16: HSDS
	NA	Same	5 F	Same	Same
	Same	Same	10 F	Same	Same
	Same	Same	15 F	Same	Same
	Same	Same	20 F	Same	Same
	Dual Unit	Same	10 F	Same	Same
	Same	Same	20 F	Same	Same
	Same	Same	30 F	Same	Same
	Same	Same	40 F	Same	Same
B. T. Enterprises	200505	I, II, III 12, 16	5 F	5¼"	I/III: DOSPLUS II, 12, 16: DOSPLUS (or) TRSDOS
	200510	Same	10 F	Same	Same
	200515	Same	15 F	Same	Same
Cameo Electronics Inc.	Subsystem 3	II	5 F, 5 R	8"	II: CP/M (or) TRSDOS ($400 extra)
	1010	Same	10 R	Same	Same
	1040	Same	40 F	Same	Same
	1050	Same	40 F, 10 R	Same	Same
	1020	Same	10 F, 10 R	Same	Same
Compukit	NA	I/III	5 F	5¼"	I/III: DOSPLUS
	Same	Same	10 F	Same	Same
	Same	Same	15 F	Same	Same
Corvus Systems Inc.	Model 6	I, II, III	6.7 F (unformatted)	5¼"	I/III: NEWDOS80 II: BIOS Driver
	Model II	Same	14.0 F (unformetted)	Same	Same
	Model 20	Same	21.0 F (unformatted)	Same	Same
I. Q. Systems	Graymatter 5	II	5 F	5¼"	CP/M
	Graymatter 10	Same	10 F	Same	Same
	Graymatter 20	Same	20 F	Same	Same
J & M Systems	JHD-III 5	III	5 F	5¼"	LDOS ($89 extra)
	JHD-III 10	Same	10 F	Same	Same
Maezon	V5000	III	5 F	5¼"	LDOS
	V10000	Same	10 F	Same	Same
	V15000	Same	15 F	Same	Same
Microcomputer Technology	E5	III	5 F	5¼"	DOSPLUS 4.0
	E11	Same	11 F	Same	Same

NA—Not Available
SS—Single-Sided
DS—Double-Sided
SD—Single-Density

Avg. Access/Retr. Time (ms)	Track-Track Access Time (ms)	Transfer Rate (K bits/s)	Mean Time Between Failure (Power-on Hours)	Daisy Chain	Warranty	Extended Warranty	Price
75	3	625	10,000	Y—4 drives	90 days P/L	N	$1995
Same	Same	Same	Same	Same	Same	Same	$2295
70	NA	500	10,000	N	6 months P/L	Y	$1995
Same	Same	Same	Same	Y—8 drives (or) up to 330 megabytes	Same	Same	$2495
Same	Same	Same	Same	Same	Same	Same	$2695
Same	Same	Same	Same	Same	Same	Same	$3150
Same	Same	Same	Same	Same	Same	Same	$3350
Same	Same	Same	Same	Same	Same	Same	$3695
Same	Same	Same	Same	Same	Same	Same	$4095
Same	Same	Same	Same	Same	Same	Same	$4995
Same	Same	Same	Same	Same	Same	Same	$5395
85	3	500	8,000	Y—4 drives	1 yr. P/L	Y	$2400
Same	Same	Same	Same	Same	Same	Same	$2550
Same	Same	Same	Same	Same	Same	Same	$2700
NA	NA	250	6,000	Y—4 drives	1 yr.—drives, 180 days—controller	Y	$5995
60	Same	Same	Same	Same	Same	Same	$5995
Same	Same	Same	Same	Same	Same	Same	$6995
Same	Same	Same	Same	Same	Same	Same	$9995
Same	15	698.8	Same	Same	Same	Same	$8995
65	1	500	11,000	Y—4 drives	1 yr.—drives, 120 days P/L	Y	$1295
Same	Same	Same	Same	Same	Same	Same	$1495
Same	Same	Same	Same	Same	Same	Same	$1695
125	625	960	NA	Y—4 drives	6 months P/L	Y	$2495
72	8.33	687	Same	Same	Same	Same	$3495
Same	Same	Same	Same	Same	Same	Same	$4495
85	3	500	11,000	N	1 yr. P/L	Y	$2195
Same	Same	Same	Same	Same	Same	Same	$2695
Same	Same	Same	Same	Same	Same	Same	$3895
NA	3	500	NA	Y—4 drives	1 yr. P/L	Y	$1795
Same	Same	Same	Same	Same	Same	Same	$1995
179	3	500	NA	Y—2 drives	1 yr. P/L	Y	$1995
Same	Same	Same	Same	Same	Same	Same	$2295
70	Same	625	Same	Same	Same	Same	$2595
153	3	500	10,000	Y—4 drives	90 days P/L, 1 yr.—circuit	Y	$1799
Same	Same	Same	Same	Same	Same	Same	$2499

DD—Double-Density
P/L—Parts and Labor
Y—Yes
N—No
F—Fixed
R—Removable

Continued from p. 235

grade, chances are you'll find it here.

Everything else is pretty much standard among these upgrades with access time about 75 ms, track-to-track access time at 5 ms, and data transfer rate around 250 Kbits/s.

Each upgrade comes with a 90-day warranty that includes parts and labor and, in a few instances, shipping costs. Several offer extended warranties, but, because they vary so much in cost and in coverage, the specifics are not included.

The price of floppy disk drives is a primary concern for many users. Regardless of your requirements, you'll find something here to ease the burden on your coffee can. If you're penny-conscious and can do without the frills, several companies, such as Interface and Microcomputer Technology, offer basic one-drive upgrade kits at reasonable prices. If you can be more flexible in your spending, you'll find everything you need from drive cabinets to multi-drives.

Hard Disk Drives

Well, here they are: the 15 companies that make hard disk drives for TRS-80 computers.

As with the floppy disk guide, OEMs are not included.

Most hard drives come with nonremovable disks and memory capacities ranging from 5 to 40 megabytes. Cameo and Santa Clara Systems, however, sell drives with removable hard disks that store 5–15 megabytes of data. These drives support several operating systems, from LDOS to DOSPLUS and from OASIS to XENIX. A few models come with CP/M, and others with a BIOS driver. Before you make a purchase, however, make sure your DOS is compatible with the drive you select.

The average access/retrieval time (the length of time it takes the read/write head to find a file on the disk) for most

HARD DISK DRIVES *(continued)*

Company	Model	For Use With Model	Data Capacity (Megabytes)	Disk Size	Operating System
Percom Data Corp.	PHDRS5	III	5 F	5¼"	LDOS (or) DOSPLUS
	PHDRS10	Same	10 F	Same	Same
	PHDRS15	Same	15 F	Same	Same
	PHDRS20	Same	20 F	Same	Same
Radio Shack (Tandy Corp.)	26-1130	I/III	5 F	5¼"	LDOS
	26-4150	II, 12, 16	8 F	8"	TRSDOS 1.6 (or) XENIX
	26-4152	Same	12 F	Same	Same
Santa Clara Systems	SCS 5	I, II, III	5 F	5¼"	TRSDOS (or) OASIS (or) DOSPLUS
	SCS 10	Same	10 F	Same	Same
	SCS 515	Same	15 F	Same	Same
	SCS 510F	Same	Dual Drive 10 F	Same	Same
	SCS 515F	Same	Dual Drive 15 F	Same	Same
	SCS 5F	Same	Dual Drive 5 F	Same	Same
	SCS 5R	Same	5 R	Same	Same
	SCS 5/5R	Same	5 F, 5 R	Same	Same
	SCS 10/R	Same	10 R	Same	Same
	SCS 15/R	Same	15 R	Same	Same
Thought Works Inc.	TR005	III	5 F	5¼"	LDOS
	TR010	Same	10 F	Same	Same
	TR016	Same	16 F	Same	Same
	TR020	Same	20 F	Same	Same
VR Data	NA	I/III	5 F	5¼"	DOSPLUS
	Same	Same	10 F	Same	Same
	Same	Same	15 F	Same	Same
	Same	Same	2×5 F	Same	Same

NA—Not Available
SS—Single-Sided
DS—Double-Sided
SD—Single-Density

HARD DISK DRIVE MANUFACTURERS

A.M. Electronics Inc.
3446 Washtenaw Ave.
Ann Arbor, MI 48104
313-973-2075

A.R. Business Systems
1128 E. Alosta Ave.
Glendora, CA 91740
213-963-7213

B.T. Enterprises
108 Carlough Road
Bohemia, NY 11716
516-567-8155

Cameo Electronics Inc.
1626 Clementine St.
Anaheim, CA 92802
714-535-1682

Compukit
16206 D Hickory Knoll
Houston, TX 77059
800-231-6671

Corvus Systems Inc.
2029 O'Toole Ave.
San Jose, CA 95131
408-946-7700

I.Q. Systems
2931 La Jolla St.
Anaheim, CA 92806
714-630-6834

J & M Systems
137 Utah N.E.
Albuquerque, NM 87108
505-265-5072

Microcomputer Technology
1530 S. Sinclair St.
Anaheim, CA 92806
714-978-9833

Maezon
1437 N. 27th Ave.
Phoenix, AZ 85009
602-272-2815

Percom Data Corp.
11220 Pagemill Road
Dallas, TX 75243
214-340-7081

Radio Shack/Tandy Corp.
One Tandy Center
Fort Worth, TX 76102
817-390-3011

Santa Clara Systems
560 Division St.
Campbell, CA 95008
408-374-6972

Thought Works Inc.
3532 W. Thomas Road Suite 2
Phoenix, AZ 85019
602-269-6841

VR Data
777 Henderson Blvd. N-6
Folcraft, PA 19032
800-345-8102

Avg. Access/Rotr. Time (ms)	Track→Track Access Time (ms)	Transfer Rate (K bits/s)	Mean Time Between Failure (Power-on Hours)	Daisy Chain	Warranty	Extended Warranty	Price
85	3	500	NA	Y—up to 20 megabytes	90 days P/L	Y	$1595
Same	Same	Same	Same	Same	Same	Same	$1995
Same	Same	Same	Same	Same	Same	Same	$2495
Same	Same	Same	Same	Same	Same	Same	$2995
75	3	500	NA	Y—2 drives	90 days P/L	Y	$2495
Same	19	400	Same	Same	Same	Same	$2495
Same	3	500	Same	Same	Same	Same	$3495
70	2	500	10,000	Y—4 drives	90 days P/L	Y	$2340
Same	Same	Same	Same	Same	Same	Same	$2840
Same	Same	Same	Same	Same	Same	Same	$3140
Same	Same	Same	Same	Same	Same	Same	$4756
Same	Same	Same	Same	Same	Same	Same	$5056
Same	Same	Same	Same	Same	Same	Same	$4474
Same	Same	Same	Same	Same	Same	Same	$2895
Same	Same	Same	Same	Same	Same	Same	$4474
Same	Same	Same	Same	Same	Same	Same	$4756
Same	Same	Same	Same	Same	Same	Same	$5056
72	2	500	8,000	Y—4 drives	90 days P/L	N	$2495
Same	Same	Same	Same	Same	Same	Same	$2995
Same	Same	Same	Same	Same	Same	Same	$3795
90	18	Same	Same	Same	Same	Same	$4495
153	3	NA	NA	N	120 days P/L	Y	$1995
Same	Same	Same	Same	Same	Same	Same	$2495
Same	Same	Same	Same	Same	Same	Same	$2995
Same	Same	Same	Same	Same	Same	Same	$3295

DD—Double-Density
P/L—Parts and Labor
Y—Yes
N—No
F—Fixed
R—Removable

hard disks was about 70–80 milliseconds, with a few taking longer at 150 to 190 ms.

A quick look at the track-to-track access time shows that most models are capable of accessing a track in 3 to 5 ms.

The average latency (the time it takes the disk to rotate once, until the desired sector reaches the head again) is 8.33 ms for all drives.

The data transfer rate (the rate at which data is loaded on or off the disk) is a more or less standard 500 Kbits/s, though there are a couple of pleasant surprises. The Corvus drives are well above this standard; the Corvus Model 6, for example, has a data transfer rate of 960 Kbits/s.

The reliability of these hard disks is indicated by the mean time between failure (MTBF). This figure is the average time between disk drive breakdowns. Ten thousand hours MTBF seems to be the most common estimate. This translates into more than a year of 24-hour-a-day operation.

Hard disk drive prices range from $1295 for Compu-kit's 5-megabyte fixed drive to $9995 for Cameo's Model 1050 with 40 megabytes of fixed memory and 10 megabytes of removable memory.

What about warranties? A hard disk doesn't help you when it's broken, except to serve as an expensive paperweight.

Every company listed in the guide has a limited warranty, usually ranging from 90 days to one year on parts and labor. Several offer an extended warranty. Extended coverage can be as low as $30 a year or as high as $35 a month. Examine the small print on the contracts very carefully. You may discover that you have to pay all shipping charges, or that only the circuitry is covered, not the drive or DOS.

If you take the time to decide how much memory you need and how much money you can spend, this buyer's guide will help you limit your choices.

Disks

A computer is virtually useless without a cassette or disk to hold information. As an addendum to this buyer's guide, we decided to list the most common floppy disks available.

This guide includes a description of the disk and the manufacturer's suggested retail price for a box of 10 disks. Although several manufacturers make special or optional disks, we list only the standard disks.

Verbatim, Dysan, and 3M all make the complete line of 5¼-inch and 8-inch disks. Because of space limitations, we could not list every disk made; Verbatim alone, for instance, makes about 40 different disks.

When using this buyer's guide, please remember that the entries represent current information which may be obsolete within three months. In fact, several companies we contacted had discontinued a product line mentioned in guides a month previous. ■

DISKS

Disk Brand	Model	Disk Type	Price/10	Warranty	Information
BASF	Qualimetric Flexidisk	5¼" SS, DD	$39.50	Lifetime	800-343-4600
	Same	8" SS, SD	$39.50	Same	Same
	NA	5¼" DS, DD	$55	Same	Same
	Same	8" SS, DD	$47.50	Same	Same
	Same	8" DS, SD	$52	Same	Same
Compu-sette	NA	5¼" SS, SD	$26.95	5 yr.	206-675-6143
	Same	5¼" SS, DD	$28.95	Same	Same
	Same	5¼" DS, DD	$32.95	Same	Same
	Soft Sectored	5¼"	$39.95	Same	Same
Dysan	#104-1	5¼" SS, SD	$47	Lifetime	408-988-3472
	#104-1D	5¼" SS, DD	$50	Same	Same
	#104-2D	5¼" DS, DD	$60	Same	Same
	#204-1D (96-TPI)	5¼" SS, DD (Quad-density)	$58.50	Same	Same
	#204-2D (96-TPI)	5¼" DS, DD (Quad-density)	$68.50	Same	Same
	*NOTE: Dysan carries the complete line of 8" disks, which range in price from $48.50 for single density, to $72 for a box of 10 hard sectored DS/DD disks.				
Elephant	*NOTE: Declined to provide information concerning their suggested retail pricing of their 5¼" and 8" floppy disks. For information, please contact: 800-538-1793.				
Maxell	NA	5¼" SS, DD	$29.90	5 yr.	800-235-4137
	Same	8" SS, DD	$39.90	Same	Same
	Same	8" DS, DD	$83.90	Same	Same

NA—Not Available
SS—Single-Sided
DS—Double-Sided
SD—Single-Density
DD—Double-Density
P/L—Parts and Labor
Y—Yes
N—No
F—Fixed
R—Removable

More

WE WILL NOT BE UNDERSOLD

TERMINALS

Zenith ZT-1	$595.00
Zenith Z-19	$679.00
Televideo 910+	$599.00
Televideo 925	$779.00
Televideo 950	$979.00
Sanyo CRX-1100	CALL

COMPUTERS

Sanyo MBC 1000 64K	CALL
Sanyo MBC 1200	CALL
Sanyo MBC 2000 dual 5¼"	CALL
Sanyo MBC 3000 dual 8"	CALL
Sanyo MBC 4000 16 BIT	CALL
ALL SANYO COMPUTERS INCLUDE WordStar, MailMerge, CalcStar, SpellStar, InfoStar	
Franklin Ace 1000 64K	CALL
Franklin Ace 1200 128K	CALL
Call for our Special System Packages!	

TELECOMMUNICATIONS

Novation Cat	$139.00
Novation J Cat	$119.00
Novation D Cat	$155.00
Novation Apple Cat	$299.00
Novation Apple Cat 1200 baud	$629.00
Novation Smart Cat	$199.00
Novation Smart Cat 1200 baud	$495.00
Hayes Micromodem II	$299.00
Hayes Smartmodem	$239.00
Hayes Smartmodem 1200 baud	$569.00
Hayes Chronograph	$229.00
Signalman Mark I	$89.00
Signalman—IBM	$189.00

DISKETTES

Verex 5¼"	$23.95
Verbatim 5½"	$26.95
Verbatim 8"	$36.95
Verbatim Head Cleaning Diskette	$9.95
Maxell MD1 5¼"	$29.95
Maxell MD2 5¼"	$44.95
Maxell FD1 8"	$37.95
Maxell FD2 8"	$44.95
5¼" File Box	$19.95
8" File Box	$21.95

MONITORS

Sanyo 9" B&W	$159.00
Sanyo 9" Green	$165.00
Sanyo 12" B&W	$179.00
Sanyo 12" Green	$199.00
Sanyo 13" Color	$399.00
SMD 13" Color	$339.00
Comrex 13" Color	$329.00
Amdek 13" Color	$329.00
Zenith 13" Color RGB	$589.00
Zenith 12" Green	$99.00
Electrohome 13" Color RGB	$599.00
Taxan 12" Amber	$139.00
Taxan 12" Green	$129.00
Taxan 12" Medium Res Color	$319.00
Taxan 12" Hi Res Color	$529.00

The CPU Computer Corporation Announces

CPUnet

The Light Fast Network that lets run CP/M™ the Apples, CP/Net™ allows you to run fast, popular CP/M™ programs, on your Apple, terminals, without disk drives! Call for more information

$2995.00

APPLE ACCESSORIES

16K Card by Microsoft	$79.00
32K Card by Saturn	$199.00
64K Card by Saturn	$419.00
128K Card by Saturn	$585.00
SoftCard Plus by Microsoft	CALL
Keyboard Enhancer by Videx	$125.00
Videoterm by Videx	$259.00
Game Paddle by TG	$49.00
Joystick by TG	$49.00
Pkaso ID-12 Card	$159.00
Pkaso EP-12 Card	$159.00
Pkaso AP-12 Card	$159.00
Pkaso NE-12 Card	$159.00
System Saver by Kensington	$75.00
Microbuffer II 16K (Apple)	$229.00
Microbuffer II 32K (InLine)	$259.00
Microbuffer II 64K (InLine)	$319.00
Add-Ram 16K by ALS	$79.00
Z-Card w/CPM by ALS	$225.00
Z-Card 64K by ALS	$299.00
Smarterm by ALS	$249.00
Smarterm II by ALS	$149.00
Dirt Cheap Video by ALS	$75.00
Color II Card by ALS	$149.00

APPLE SOFTWARE

MICROPRO	
WordStar	$379.00
MailMerge	$190.00
SpellStar	$190.00
DataStar	$259.00
CalcStar	$115.00
VISICORP	
VisiCalc	$199.00
VisiTerm	$89.00
VisiDex	$199.00
VisiPlot	$169.00
VisiFile	$199.00
VisiSchedule	$259.00
VisiTrend/Plot	$259.00
VisiLink	$199.00
Visicalc Business Model	$89.00
MISCELLANEOUS	
MicroTerminal	$69.00
Screenwriter II	$99.00
Dictionary	$79.00
DB Master	$169.00
PFS Filing System	$99.00
PFS Report	$75.00
PFS Graph	$99.00
Easy Writer Pro	$199.00
Easy Mailer Pro	$79.00
Z-Term Pro	$129.00
Word Handler	$149.00
MultiPlan by Microsoft	$229.00
dBase II	$489.00
HowardSoft Tax Preparer	$149.00

IBM PC HARDWARE

Quadram 128K Ram Card	$599.00
Quadram 192K Ram Card	$719.00
Quadram 256K Ram Card	$795.00
Microsoft 64K Ram Card	$399.00
Microsoft 192K Ram Card	$699.00
Microsoft 256K Ram Card	$799.00
Joystick by TG	$49.00
Tandon TM 100-2 Raw Drive	$279.00

IBM PC SOFTWARE

INFORMATION UNLIMITED	
Easy Writer	$289.00
Easy Speller	$149.00
Easy Filer	$319.00
VISICORP	
VisiCalc 256K	$199.00
VisiDex	$209.00
VisiFile	$259.00
VisiTrend/Plot	$259.00
VisiSchedule	$259.00
VisiWord	$329.00
MICROPRO	
WordStar	$379.00
MailMerge	$195.00
MISCELLANEOUS	
SuperCalc	$279.00
SuperWriter	$289.00
Home Accountant +	$129.00
dBase II	$495.00

DISK DRIVES

CCI 121 add-on for Sanyo MBC 1000	$359.00
CCI 100 for the TRS 80 Model I 5¼" 50 track	$299.00
Corvus 5M with Mirror	$2895.00
Corvus 10M with Mirror	$3679.00
Corvus 20M with Mirror	$4579.00
Rana Systems for the Apple II	
Elite One 40 track	CALL
Elite Two 80 track	CALL
Elite Three 80 track, double side	CALL
Elite Controller	CALL
Sanyo EFD 160	$699.00

RAM

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Programming the Model 16

by Dan Keen and Dave Dischert

Since the arrival of the new 16-bit processors, it is increasingly difficult to define the line separating microcomputers from minicomputers.

TRS-80 owners who have dabbled in Z80 Assembly language might be curious about the differences in writing programs for the new Model 16 with its powerful Motorola MC68000 microprocessor.

The MC68000 is not directly compatible with any other microprocessor, including the 8-bit MC6800 chip. Motorola decided to create instructions that make the most efficient use of the MC68000 chip rather than emphasize compatibility.

Eight data registers, named A0 through A7, and eight address registers, D0 through D7, give this chip real flexibility. Each register is 32 bits long, so that a programmer can store memory address locations without having to put registers in pairs, as is necessary when programming the Z80.

The familiar PC register is again called the program counter register here and it, too, consists of 32 bits.

A 16-bit status register resembles the Z80 flag register. An overflow bit, carry bit, and Z-flag bit are part of this register as well. Their functions are identical to these Z80 flags, so many programming concepts for other microprocessors are applicable here.

Instructions

Many opcodes comprise the 68000 instruction set. But, as in the case of the Z80, many are simply variations of each other and can be grouped together to perform similar functions.

When writing Assembly-language programs for the Z80, it is usually necessary to pair registers in order to store a memory address up to 65,535 (64K).

The MC68000 has registers that can

The 16-bit MC68000 microprocessor is fast, flexible, and not too hard to understand.

be accessed as 32-bit units. This lets it directly access any memory location up to 16 megabytes. Consequently, the MC68000 is capable of executing instructions with great speed.

Registers that are 32 bits wide and hold 4 bytes of information are called long words. Instruction codes can be kept simple by using 4-byte registers. One instruction does the work that takes several instructions with an 8-bit processor.

Another advantage to using 32-bit registers is that it ensures future editions of the MC68000 chip. Radio Shack was wise in using this microprocessor in the Model 16. Motorola designed this chip to be manufactured as a 32-bit processor when the technology permits.

So, while some microcomputer manufacturers use 16-bit chips at their maximum capability, Radio Shack is looking down the road.

It takes at least four separate lines of instruction code to make the Z80 microprocessor move a byte of information from one memory location to another. First, the destination address is read into a register pair. Then the source address is similarly loaded into another pair. The byte of data is then placed into a register and the contents dumped back out into the destination address. The source listing might appear as:

```
LD   DE,destination address
LD   HL,source address
LD   A,(HL)
LD   (DE),A
```

Using the Model 16 assembler, the MC68000 instruction would be:

```
MOVW     @A0,#NUMBER
```

The label number is defined and equated to a value elsewhere in the program. The instruction above takes the number stored in the address NUMBER, and places it in the memory address indicated by register A0.

Not all instructions are that powerful, but the MOV or move command represents many codes that perform several tasks simultaneously.

When addressing registers in the 68000, you must specify the length of the operand associated with the mnemonic. In the above move instruction, the letter W is tacked onto the end of the mnemonic MOV. The sizes and their representation of these lengths are B for byte, W for a word, and L for long word. The instruction ADDW means the add instruction acts on 2 bytes. Most instructions consist of two bytes rather than a single byte, as with 8-bit processors.

Addressing Modes

When programming the Z80, you address registers either directly or indirectly. Direct addressing applies when the operand is in the register, and indirect when the register holds the reference address that holds the operand.

Radio Shack's Editor/Assembler for the Z80 allows you to place parentheses around a register to indicate that it is to be indirectly accessed. In the instruction:

```
LD   (HL),A
```

the register pair HL is indirectly addressed. The parentheses tell the computer that the value stored in A is not to

```
START       LDA     .A0,SVC BLOCK
            LDW     .A1,#BUFFER LENGTH
            LDW     .A2,#TERMINATOR
            LDW     .A3,MESSAGE1
            MOVW    @A0,#VDLINE SVC NUMBER
            STW     .A1,6@A0
            STW     .A2,8@A0
            STL     .A3,10@A0
            BRK     #0
JPDOS       LDA     .A0,SVC BLOCK
            MOVW    @A0,#JPDOS SVC NUMBER
            BRK     #0
MESSAGE1    TEXT    '80 MICROCOMPUTING MAGAZINE'
ST          EQUW    13
SVC BLOCK
            RDATAB  32,0
VDLINE SVC  NUMBER
            EQUW    9
JPDOS SVC   NUMBER
            EQUW    264
BUFFER LENGTH
            EQUW    255
TERMINATOR
            EQUW    13
            END     START
```

Fig. 1. Model 16 Assembly Program Listing

be placed directly into HL, but rather in the memory location indicated by HL.

Similarly, on the MC68000, a period placed before a register specifies a direct operation and the @ sign indicates that the operand is in the location pointed to by the address register. In the MOV instruction just discussed, you can see that @A0 is indicating that the contents of that register were the address we were to use.

.A1 represents a direct action on register A1.
@A0 represents an indirect action on register A0.

When writing programs for 8-bit microprocessors, the programmer must not be concerned about whether the byte placement of an instruction is even or odd since all registers are only 1 byte long. This is an added parameter that must be dealt with when programming the MC68000. Most instructions are 2 bytes long, and a word or long-word operand must fall on an even byte address.

It may seem unusual at first, but it is unnecessary to use an origin pseudo-op or directives, when writing a 68000 program on the Model 16. By not specifying an origin, the assembler automatically places the program in the next available RAM area after TRSDOS and any utility programs are loaded.

The editor/assembler program that Radio Shack provides with the Model 16 is more difficult to work with than their Z80 package. You must spend some time getting acquainted with this editor/assembler before doing any serious programming.

Supervisor Calls

Like the other TRS-80 computers, the Model 16 disk operating system contains many user routines. These supervisor calls can be jumped to from machine-language programs. These calls facilitate communication between the keyboard, video display, line printer, and disk drives.

Before carrying out many Z80 instructions, you must set up certain registers. Prior to using an LDIR mnemonic, load the source address into register pair HL, the destination address into DE, and the number of bytes to copy into BC.

Similarly, before executing a supervisor call, a buffer area in RAM must be established and certain values placed at key positions within it. The instruction BRK #0 calls the routine.

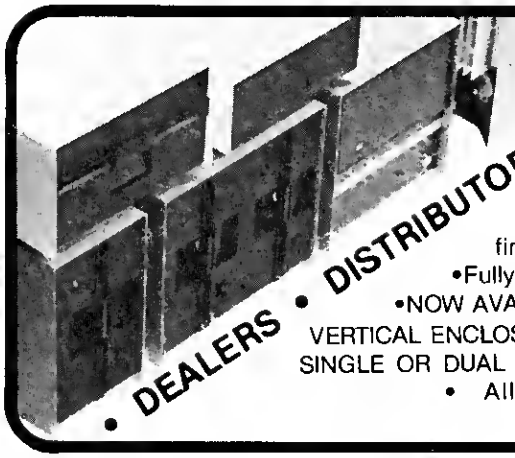
Figure 1 shows a listing created with the Assembler 16. This short program shows two supervisor routines being accessed, displaying text on the screen and returning to the TRSDOS ready mode.

Writing Assembly-language programs for the 68000 is no harder than writing for the Z80; it is merely different, because some new rules apply due to the longer byte length of registers and instructions.

A computer's ability to execute instructions increases more rapidly if it uses a 16-bit processor instead of an 8-bit processor.

A 32-bit, single-chip microprocessor is expected in 1985. By that time, technology will have reached the point where man can package over one million transistors in a single integrated circuit. ■

Dan Keen and Dave Dischert can be reached c/o Soft Horizons, RD1 Box 432, Cape May Court House, NJ 08210.



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Kilobaud Microcomputing in April 1981 ran an article on a flowchart generator by Peter A. Stark. This interested me, so I translated the program for my TRS-80.

Since the original article had extraordinary remark statements, I tried to keep the same line numbers. I dropped his remark statements in my translation, though I had to use the two arrays in storing the to and from pointers (original array) S(i) and added SL (i) for the lower half. This was necessary since the full eight-digit floating-point number used originally didn't always give the correct answer during my test phase. This problem was pointed out in the original article and the modifications were shown.

Table 1 contains the new or revised line numbers and comments to go from Percom Super Basic to Radio Shack Disk Basic.

Many TRS-80 programmers like to stack as many statements as possible on one line. This causes problems in the printing even if you only print the keywords. A condensed line sometimes is too large for the available printing area and if left unfixed throws off all the printing.

The following lines handle this situation: Lines 2041–2043 check the length of the condensed line and truncate where necessary. Place a plus sign at the end to highlight if the truncation is performed.

Lines 2210–2230 of the original program use the function POS that indicated the head position of the printer display. I replaced this function with hard code to increase the display to more than 80 characters per line for users with this equipment.

For print characters used to show directions, I replaced the symbol with CHR$() commands as follows:

CHR$(96) down arrow
CHR$(95) left arrow
CHR$(94) up arrow
CHR$(126) right arrow

After debugging and fixing my keying errors, I had to test the program on something

```
100 REM ** PARITAL PROGRAM TO TEST FLOW CHART PROGRAM **
110 CLEAR:CLOSE:CLEAR8800:DEFINTI-N:DIMGL$(100),CC(39):DIMCA$(6)
:T$="##,###,###.##-":U$="####.#-"
111 FORI=1TO39:READCC(I):NEXTI
112 DATA -88900,-1100,-200,-5000,-2500,-1700,0,0
113 DATA 15280,1223,700,2462,5200,2800,300,300,300,2100,2100
114 DATA 3150,1200,570,800,120,750,4000,700,4000,4000,800
115 DATA 1200,2800,1800,14481,7770,400,800,0,0
120 OPEN"R",1,"TRY1"
130 FORI=1TO6:S=1+INT((I+1)/2):R1=I+2*(2-S):FIELD1,127*(R1-1)+1A
S F3$,20AS CT$:GET1,S:CA$(I)=CT$:NEXTI
140 FIELD1,4AS D8$,30AS C2$,10AS F1$,4AS DS$,2AS MF$,83AS F2$,6A
S FA$,8AS AP$,2AS LR$,10AS FD$,2AS KS$,2AS NP$,2AS NR$,2AS NS$:G
ET1,1:KU$=LEFT$(KS$,1):XU#=0:XY#=0
150 DT$=STR$(CVS(D8$)):IFLEN(DT$)=7THENDT$=RIGHT$(DT$,6)
160 DT$=LEFT$(DT$,2)+"/"+MID$(DT$,3,2)+"/"+RIGHT$(DT$,2)
170 CLS:INPUT"PRINT INCOME STATEMENT (Y/N)";Y$
180 IFY$="Y"GOTO210
190 IFY$<>"N"GOTO170
200 LOAD"XYZ",R
210 INPUT"PERIOD-ENDING DATE (MM/DD/YY)";DP$
211 INPUT"NUMBER OF MONTHS INTO THE YEAR";IM
212 OPEN"O",3,"LISTCH:1"
220 IFLEN(DP$)<>8GOTO210
230 OPEN"R",2,"DATA88:1"
240 FORI=1TO100
250 S=INT((I+3)/4):R1=I-4*INT((I-1)/4)
260 FIELD2,63*(R1-1)AS Y$,63AS A$:GET2,S:GL$(I)=A$:PRINT@192,"AC
CT:";I;USING"####";CVI(LEFT$(A$,2));
270 NEXTI
280 N=0:L=50:BM#=0:BC#=0:BY#=0:BP#=0:BR#=0:B1#=0:B2#=0:IC=0:CK$=
"":NS=CVI(NS$):SN#=0:SY#=0:CC$=""
290 FORI=1TO100
300 I1=I:IFCVI(LEFT$(GL$(I),2))<3000GOTO320
310 I=100
320 NEXTI
330 IFCVI(LEFT$(GL$(I1),2))>3000GOTO350
340 PRINT"NO ACCOUNTS ":FORJ=1TO2000:NEXTJ:GOTO180
350 SN#=0:SY#=0:FORI=I1TO100
360 I2=I:E$=GL$(I):IF MID$(E$,52,1)<>"3" GOTO 380
370 SN#=SN#+CVD(MID$(E$,44,8)):SY#=SY#+CVD(MID$(E$,26,8))
380 NEXTI
```

Program Listing 1. Flowchart test listing

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*Michael Tannenbaum, the "80 Accountant"

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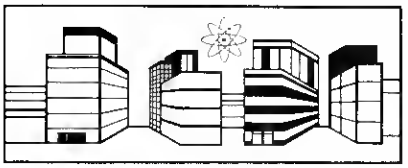

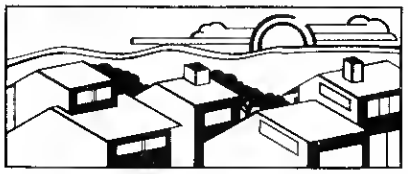

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more than Mr. Stark's brief example. I stripped the first 35 lines from a program I had in order to get a true listing with the arrows and switches. Program 1, TEST/DAT, shows the original coding and Program Listing 2 is the actual flowchart program.

The program works well enough, but it does have several shortcomings. The program uses keywords and special characters to strip a line of code; this sometimes causes false errors. Notice in Fig. 1 (the flowcharted diagram for Listing 1) that asterisks appear at lines 212 and 230. This was caused by the colon in the file specification; after the colon, the program looks for a keyword and can't find one and therefore prints the error message. Similar errors appear from time to time especially in program lines that have keywords in quotes.

There are a few minor traps TRS-80 users should be aware of. First, my translation only allows for four-digit numbers even though RS Basic allows for numbers up to 65529. If your program has five-digit line numbers, renumber with any one of a number of packages now on the market (also in Disk Basic).

Second, each Next must have the counter-variable following, or you get the error "Missing Next I" at the bottom of the flow printout. Also the Do column will be full of down arrows to the bottom of the display.

Third, the Basic program to be processed must be saved with the A option.

Finally, as Mr. Stark pointed out, the program takes time to run. It took about 15 minutes to process a program that had approximately 170 lines.

For programmers with the ability to print more than 80 characters per line, this modification should help you print more information on the condensed line output:

```
2041 IF LC<50 THEN 2043
2042 C$ = LEFT$(C$,49) + " + "
2230 FOR K = P3 TO 79 STEP 2
```

I now have a program to flowchart Basic programs and the knowledge I picked up will help if I start on other projects of the same nature. ■

Line 1:	Clearing necessary string space
Line 2:	K9 = number of keywords to be checked
Line 3:	LY = 1 if only 10 branches wanted, 2 if 20 branches wanted (the line printer must have 120 characters per line) LL = maximum number of characters possible in Radio Shack Disk Basic, 255 KS sets printer loops for 10 or 20 branches
Line 5:	Reminder to have 120 CPL if LY = 2
Lines 170–177:	Keywords TRS source—original program had them in lines 3330–3420
Line 180:	Title for the top of the chart (new)
Lines 221–224:	Needed to add this since the original program had to have a four-digit line number on each statement. This patch of code pads the line number with zeros. Same for lines 982–986.

Table 1

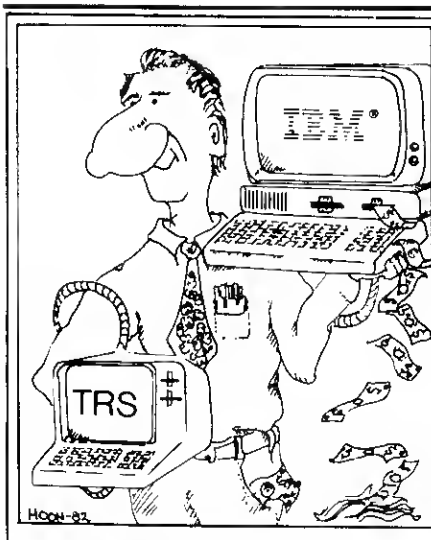
```
                FLOW DIAGRAM FOR: TEST/DAT:1
                     0100      .
                     0110 CLEAR :CLOSE :CLEAR :DEFINT +
--------------------0111 FOR I:READ :NEXT I
                     0112 DATA
                     0113 DATA
                     0114 DATA
                     0115 DATA
                     0120 OPEN
--------------------0130 FOR I:S= :R1= :FIELD :GET :C+
                     0140 FIELD :GET :KU$= :XU$= :XY$=+
                     0150 DT$= :IF
                     0160 DT$=
                     0170 CLS :INPUT ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ←
                     0180 IF - - - - - - - - - - - - - - - - - - - - - - - - -←→↓ ↑
                     0190 IF → → → → → → → → → → → → → → → → → → → → → →↑→↓→↑
                     0200 LOAD                                              ↑ ↓
                     0210 INPUT  ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ←↑←←←←
                     0211 INPUT                                             ↑   ↑
                     0212 OPEN :***                                         ↑   ↑
                     0220 IF → → → → → → → → → → → → → → → → → → → → → →↑→ →↑
                     0230 OPEN :***                                         ↑
↓--------------------0240 FOR I                                            ↑
↓                    0250 S= :R1=                                          ↑
↓                    0260 FIELD :GET :GL$(I)= :PRINT :+                    ↑
---------------------0270 NEXT I                                           ↑
                     0280 N= :L= :BM$= :BC$= :BY$= :BP+                    ↑
↓--------------------0290 FOR I                                            ↑
↓                    0300 I1= :IF  → → → → → → → → → → → → → → → → → → → →↑→ →↓
↓                    0310 I=                                               ↑   ↓
---------------------0320 NEXT I ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ←↑← ←←
                     0330 IF → → → → → → → → → → → → → → → → → → → → → →↑→↓
---------------------0340 PRINT :FOR J:NEXT J:GOTO → → → → → → → → → → →↑ ↓
↓--------------------0350 SN$= :SY$= :FOR I← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ←←
↓                    0360 I2= :E$= :IF → → → → → → → → → → → → → → → → → →↓
↓                    0370 SN$= :SY$=                                       ↓
---------------------0380 NEXT I ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ← ←←
```

Figure 1

Program Listing 2. Flowchart

```
1 CLEAR 3000
2 K9=35:DIM K$(K9),L$(10),R(20),H$(20),S(500),SL(500),Sl(500)
3 LY=1:KS=LY*10:LL=255:S6=0:S5=0
5 IF LY=1 GOTO 10
6 PRINT"Line printer set at 120 CPL";:GOSUB3400:IFX%=1GOTO10 ELS
EEND
10 CLS:PRINT"      FLOGEN - BASIC FLOWCHART PROGRAM"
20 PRINT"   MICROCOMPUTING April 1981 BY P A Stark"
30 PRINT"      Modified for TRS-80 by P R Ohs":PRINT
60 PRINT"Remember program must have been saved with 'A' option":
PRINT""
70 PRINT" ":INPUT"Enter file name of source program to be charte
d";N$
80 INPUT"What drive is it stored on( (0-3)";D$
85 IF VAL(D$)<0 OR VAL(D$)>3 GOTO 80
90 N$=N$+":"+D$
93 PRINT"The file name is ";N$;" is this correct (Y/N)";:GOSUB34
00
95 IF X%<>1 GOTO 70
170 FOR K=1TOK9:READ K$(K):NEXT K
171 DATA REM,GOTO,THEN,GOSUB,STOP,END
172 DATA FOR,NEXT,IF,RETURN,READ
173 DATA INPUT,LINEINPUT,PRINT,LPRINT,OPEN
174 DATA CLOSE,RESTORE,ON,DIM,DATA
175 DATA STOP,CLS,POKE,PEEK,CLEAR
176 DATA DEFFNO,DEFSTR,DEFINT,DEFSNG,DEF
177 DATA FIELD,GET,LOAD,***
180 LPRINTTAB(15);"FLOW DIAGRAM FOR: ";N$
200 ON ERROR GOTO 3500:OPEN "I",1,N$
210 IF JP=1 THEN 760
212 LINEINPUT#1,A$
220 IF EOF (1) THEN JP=1
221 K1=INSTR(1,A$," ")
222 IF K1=5 THEN 229
224 FOR I=K1TO4:A$="0"+A$:NEXT I
229 PRINT A$
230 L=LEN(A$)
250 S$=LEFT$(A$,6)
270 IF MID$(A$,6,3)="REM" THEN 210
290 FOR I=7TO L
300 B$=MID$(A$,I,1)
310 IF B$<>" " THEN S$=S$+B$
320 NEXT I
350 L=LEN(S$)
360 IF L<10 THEN 210
370 FOR I=6 TO L
380 B$=MID$(S$,I,4)
390 IF B$=":REM" THEN 210
400 IF B$="GOTO" THEN 470
410 IF B$="THEN" THEN 470
420 GOTO 440
440 NEXT I
450 GOTO 210
470 B=4
510 C=VAL(LEFT$(S$,4))
520 P=I+B
530 T$=MID$(S$,P,1)
540 GOSUB 3040
550 IF T=0 THEN I=I+B: GOTO 440
570 D=VAL(T$)
580 FOR J=P+1 TO P+3
590 T$=MID$(S$,J,1)
600 GOSUB 3040
610 IF T=0 THEN 650
620 D=D*10 + VAL(T$)
630 NEXT J
650 S6=S6+1
660 IF C<D THEN SL(S6)=D
661 IF C<D THEN S(S6)=C:Sl(S6)=1
670 IF C>D THEN SL(S6)=C
671 IF C>D THEN S(S6)=D:Sl(S6)=2
690 IF MID$(S$,J,1)="," THEN P=J+1 : GOTO 530
710 GOTO 440
760 M=S6
770 M=INT(M/2)
780 IF M=0 THEN 960
790 K=S6-M
800 J=1
810 I=J
820 L1=I+M
830 IF(S(I)+SL(I)/1000)<(S(L1)+SL(L1)/1000) THEN 920
```

Listing 2 continues



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Listing 2 continued

```
840 A=S(I):AL=SL(I)
850 S(I)=S(L1):SL(I)=SL(L1)
860 S(L1)=A:SL(L1)=AL
870 A=S1(I)
880 S1(I)=S1(L1)
890 S1(L1)=A
900 I=I-M
910 IF I>=1 THEN 820
920 J=J+1
930 IF J>K THEN 770
940 GOTO 810
960 JP=0:CLOSE:OPEN "I",1,N$
970 IF JP=1 THEN 2440
972 LINEINPUT#1,S$
980 IF EOF(1) THEN JP=1
982 K1=INSTR(1,S$," ")
984 IF K1=5 THEN 990
986 FOR I=K1TO4:S$="0"+S$:NEXT I
990 C$=LEFT$(S$,5)
1000 B=6
1010 R4=0 : R5=0
1020 GOSUB 2570
1050 L3=0
1060 GOSUB 3110
1080 IF K$="STOP" THEN K$="***STOP***"
1090 IF K$="END" THEN K$="***END***"
1100 IF K$="GOSUB" THEN K$="GOSUB-->"
1110 IF K$<>"REM" THEN C$=C$+K$+" "+V$
1140 B=B+1
1150 A$=MID$(S$,B,1)
1160 IF A$="" THEN 1320
1170 IF A$<>":" THEN 1140
1180 B=B+1
1190 A$=MID$(S$,B,1)
1200 IF A$=" " THEN 1180
1210 IF A$="" THEN 1320
1220 GOSUB 2570
1230 GOSUB 3110
1240 IF K$="STOP" THEN K$="***STOP***"
1250 IF K$="END" THEN K$="***END***"
1260 IF K$="GOSUB" THEN K$="GOSUB-->"
1270 IF K$<>"REM" THEN C$=C$+":"+K$+" "+V$
1280 GOTO 1140
1320 FOR K=1 TO KS
1330 IF R(K)=.5 THEN R(K)=0
1340 IF R(K)=.4 THEN R(K)=0
1350 IF R(K)=1 THEN R(K)=.5
1360 IF R(K)=.9 THEN R(K)=.4
1370 NEXT K
1390 L6=VAL(LEFT$(S$,4))
1400 FOR K=1 TO KS
1410 IF ABS(R(K))<>L6 THEN 1510
1430 IF R(K)>0 THEN 1490
1450 IF R5<K THEN R5=K
1460 R(K)=.9
1470 GOTO 1510
1490 IF R4<K THEN R4=K
1500 R(K)=1
1510 NEXT K
1540 IF S5=S6 THEN 1600
1550 T=INT(S(S5))
1560 IF T>=L6 THEN 1600
1570 IF T<>0 THEN LPRINT"ERROR - MISSING LINE NUMBER";T
1580 S5=S5+1
1590 GOTO 1540
1600 IF INT(S(S5))<>L6 THEN 1940
1620 D9=SL(S5)
1630 S(S5)=0:SL(S5)=0
1650 FOR K=1 TO KS
1660 IF ABS(INT(R(K)))=D9 THEN 1700
1670 NEXT K
1680 GOTO 1730
1700 IF S1(S5)=1 THEN IF R(K)>0 THEN 1830
1710 IF S1(S5)=2 THEN IF R(K)<0 THEN 1870
1730 FOR K=KS TO 1 STEP-1
1740 IF R(K)=0 THEN 1780
1750 NEXT K
1760 GOTO 1890
1780 IF S1(S5)=1 THEN 1820
1790 IF S1(S5)=2 THEN 1860
1800 LPRINT"ERROR ON ";S$ :STOP
1820 R(K)=D9
1830 IF R5<K THEN R5=K
1840 GOTO 1890
```

Listing 2 continues

"THERE IS ONLY ONE WAY TO DESCRIBE THE PERFORMANCE OF POSTMAN MASS MAILING SYSTEM, – 'FLAWLESS'."

Info World, by Tim Daneliuk, Vol. IV, No. 37. ©1982

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ERROR HANDLING – All erroneous data is trapped. It never fails because of incorrect operator entry.

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Q. How many names can I get on my standard 2 drive TRS-80 Mod III?

A. On the average 1900, depending on your operating system. LDOS is the least – Multi-DOS has over 2,000.

Q. How many disk drives can I run at the same time with your program?

A. At this time only 8 disk drives – 4 floppy disks and 4 hard disks.

Q. What is the capacity of a disk drive?

A. There are many different sizes of disk drives. See the chart below.

MOD I SINGLE DENSITY
- †35 Track Data Disk ..... 642 ea.
- 40 Track Data Disk ..... 742 ea.
- 80 Track Data Disk ..... 1542 ea.

MOD I OR III DOUBLE DENSITY
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†Denotes the size on a standard system from Radio Shack. ††Requires LDOS or DOSPLUS Operating Systems and hard disk version of Postman.

Q. Am I limited to only one disk drive or can I add more drives?

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Q. Outstanding having all those names, but how does it effect the speed of the system?

A. As anyone could expect, as a system gets larger it reacts slower. Below is a sample of the different systems.

SYSTEM CAPACITY	SORT TIME - ONE FIELD	SORT TIME - ALL 10 FILEDS	INSERT TIME
1,342	12 Seconds	16 Seconds	1 Second
5,500	18 Seconds	28 Seconds	1 Second
11,000	24 Seconds	40 Seconds	2 Seconds
38,000	5 Minutes	7 Minutes	2 Seconds
78,000	8 Minutes	12 Minutes	2 Seconds
200,000	30 Minutes (estimated)	51 Minutes	4 Seconds

The above tests were done with a Mod III and DOSPLUS 4.0 Operating System. The speed you receive will depend on many factors. It should be noted that as you insert a name, it is put in sorted order on the disk. You never need to re-sort, unless you wish to change the order.

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Listing 2 continued

```
1860 R(K)= -D9+.5
1870 IF R4<K THEN R4=K
1890 IF S5=S6 THEN 1940
1900 IF INT(S(S5+1))=L6 THEN S5=S5+1 : GOTO 1540
1940 FOR K= 1 TO KS
1950 H$(K)="-"
1960 IF K>L3 THEN H$(K)=" "
1970 NEXT K
1990 FOR K= 10 TO 1 STEP-1
2000 IF L$(K)="" THEN LPRINT H$(K);H$(K);
2010 IF L$(K)<>"" THEN LPRINTCHR$(96);H$(K);
2020 NEXT K
2040 LC=LEN(C$)
2041 IF LC<34 THEN 2043
2042 C$=LEFT$(C$,33)+"+"
2043 LPRINT C$;
2070 FOR K=1TOKS
2080 H$(K)=" "
2090 IF K<=R4 THEN 2150
2110 IF K>R5 THEN 2190
2130 H$(K)=CHR$(126)
2140 GOTO 2190
2150 IF K>R5 THEN 2180
2160 H$(K)="-"
2170 GOTO 2190
2180 H$(K)=CHR$(95)
2190 NEXT K
2210 P3=LEN(C$)+25
2215 IF P3<>INT(P3/2)*2 THEN 2230
2220 LPRINT" ";:P3=P3+1
2230 FOR K=P3 TO 59 STEP 2
2240 LPRINT H$(1);" ";
2250 NEXT K
2270 FOR K=1 TO KS
2280 LPRINT H$(K);
2290 IF R(K)>1 THEN LPRINT CHR$(96);
2300 IF R(K)=1 THEN LPRINT CHR$(95);
2310 IF R(K)=.9 THEN LPRINT CHR$(94);
2320 IF R(K)=.5 THEN LPRINT " ";
2330 IF R(K)=.4 THEN LPRINT " ";
2340 IF R(K)=0 THEN LPRINT " ";
2350 IF R(K)>=0 THEN 2390
2360 IF R(K)=INT(R(K)) THEN LPRINT CHR$(94); :GOTO 2390
2370 LPRINT CHR$(95);
2380 R(K)=R(K)-.5
2390 NEXT K
2400 LPRINT " "
2420 GOTO 970
2440 CLOSE
2460 FOR K=1TO KS
2470 IF L$(K)<>"" THEN LPRINT"ERROR - MISSING NEXT ";L$(K)
2480 NEXT K
2490 FOR K=1TO KS
2500 IF R(K)>1 THEN 2530
2510 IF R(K)<0 THEN 2530
2520 GOTO 2540
2530 LPRINT"ERROR - MISSING LINE NO. ";INT(R(K))
2540 NEXT K
2550 END
2570 FOR K=1TO K9
2580 L=LEN(K$(K))
2590 IF MID$(S$,B,L)=K$(K) THEN 2750
2600 NEXT K
2620 FOR K=B TO LL
2630 T$=MID$(S$,K,1)
2640 IF T$="" THEN 2730
2650 IF T$=":" THEN 2730
2660 IF T$="=" THEN 2700
2670 NEXT K
2680 LPRINT"ERROR - UNDECEIPHERABLE STATEMENT" :STOP
2700 T$=MID$(S$,B,K-B+1): K=0
2710 GOTO 2750
2730 K=K9
2740 GOTO 2750
2750 K$=T$
2760 IF K<>0 THEN K$=K$(K)
2770 V$=""
2790 IF K$="FOR" THEN 2830
2800 IF K$="NEXT" THEN 2950
2810 RETURN
2830 FOR K=B+3 TO LL
2840 IF MID$(S$,K,1)="=" THEN 2880
2850 NEXT K
2860 LPRINT"ERROR IN LINE ";S$ :STOP
```

Listing 2 continues

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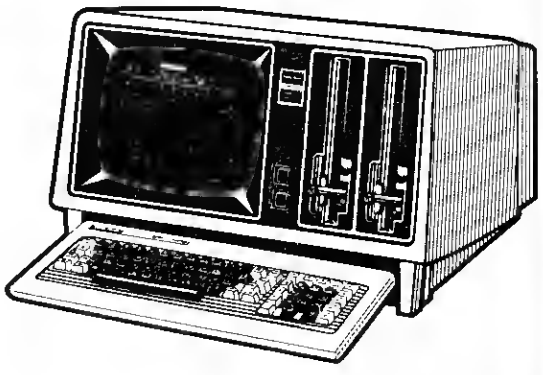

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Listing 2 continued

```
2880 A$=MID$(S$,B+3,K-B-3)
2900 FOR K=1 TO LEN(A$)
2910 IF MID$(A$,K,1)<>" " THEN V$=V$+MID$(A$,K,1)
2920 NEXT K
2930 RETURN
2950 FOR K=B+4 TO LL
2960 IF MID$(S$,K,1)="" THEN 3010
2970 IF MID$(S$,K,1)=":" THEN 3010
2980 NEXT K
2990 PRINT"ERROR IN LINE ";S$ :STOP
3010 A$=MID$(S$,B+4,K-B-4)
3020 GOTO 2900
3040 REM
3050 T=0
3060 IF T$<"0" THEN RETURN
3070 IF T$>"9" THEN RETURN
3080 T=1
3090 RETURN
3110 IF K$="NEXT" THEN 3240
3120 IF K$<>"FOR" THEN RETURN
3150 FOR K=KS TO 1 STEP-1
3160 IF L$(K)="" THEN 3200
3170 NEXT K
3180 LPRINT"ERROR - TOO MANY NESTED LOOPS IN ";S$:STOP
3200 L$(K)=V$
3210 IF L3<K THEN L3=K
3220 RETURN
3240 FOR K= 1 TO KS
3250 IF L$(K)=V$ THEN 3290
3260 NEXT K
3270 LPRINT"ERROR - NEXT WITHOUT FOR?"
3280 RETURN
3290 IF L3<K THEN L3=K
3300 L$(K)=""
3310 RETURN
3400 A$=INKEY$:IFA$=""GOTO3400
3410 IF ASC(A$)>96 A$=CHR$(ASC(A$)-32)
3420 PRINTA$:X%=INSTR("YN",A$):RETURN
3500 PRINT@660,"File not found":FORLL=1TO900:NEXTL:RESUME70
```

Model II/16 Conversion

CONVERSION BY TOM YAGER

DELETE THE FOLLOWING LINES:

```
180
```

ADD THE FOLLOWING LINES:

```
75 IF INSTR(N$,":")<>0 THEN 93
```

EDIT THE FOLLOWING LINES:

```
70 PRINT:INPUT"Enter file name of source program to be charted";N$
176 DATA DEFPN,DEFSTR,DEFINT,DEFSNG,DEF
200 ON ERROR GOTO 3500:OPEN "I",1,N$:LPRINTTAB(15);"FLOW DIAGRAM FOR: ";N$
2490 FOR K=1TO KS
2840 IF MID$(S$,K,1)="=" THEN 2880
3410 IF ASC(A$)>96 THEN A$=CHR$(ASC(A$)-32)
```


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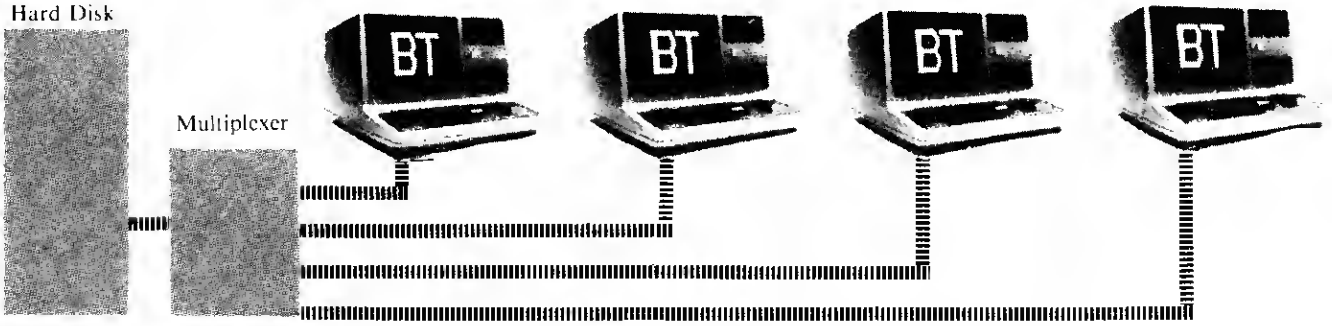

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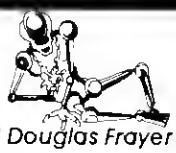

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By Bill Dunlevy and Douglas Frayer
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The first TRS-80 totally original arcade game to have screen movement in all four directions. Use multiscreen or scanner view of entire complex. Cyborg, the space gladiator, explores the 20 levels of mazes of an interstellar space-station arena to find energy signal modules. Avoid or chase down threatening, frenzied robots. 4 skill levels for 1-4 players with incredibly smooth, fast action graphics and arcade sound. Joystick compatible.

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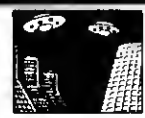

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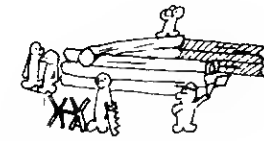

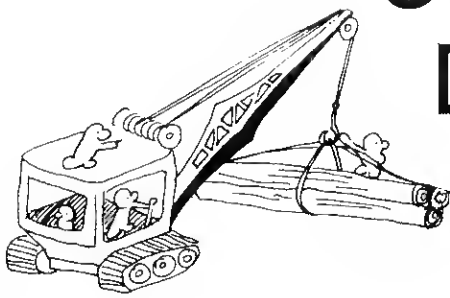

Using Data Files—Part I

by Jesse W. Baker

Data files consist of characters stored on magnetic disks independent of other programs. You can learn to handle them efficiently.

TRS-80s use two types of disk file structures to store information and/or data: sequential-access and random- or direct-access. This article discusses how to create and use the sequential file structure.

Two disk sizes are available: a 5¼-inch mini-disk and an eight-inch disk. Both sizes have limited data storage capacity, and must be used with file structures that ensure the most efficient use of available space. This is determined by the type of operating system on the computer.

The storage capacity on the 5¼-inch disk under TRSDOS is approximately 184,000 bytes of data on 40 tracks in the double-density format.

Close	Used to free the file buffer for other uses and to secure the file. Used by both sequential and random-access files.
Delimiter	A character used by the computer to mark the end of one data item and the start of another.
EOF	End Of File. This allows you to test for the end of file. If you try to read past the end of file you get an error.
Field	An item of information within a record. Example: An individual's name.
File	A group of related records. Example: A mailing list.
I	Tells the computer that the sequential file contents will be read (input) from the disk to the memory.
INPUT #	Reads data from a sequential file.
LINE INPUT #	Reads a line of text from a disk file, one line at a time. Will usually recognize only a carriage return as a delimiter.
O	Tells the computer that the data in memory is sent to the file.
Open	A statement that gives you access to a sequential file. Used by random-access files also.
PRINT #	Writes information to a sequential file.
Record	A complete group of related data. Example: A person's name and address.

Table 1. Glossary of Terms

The eight-inch disk capacity is approximately 500,000 bytes. A double-density disk has 77 tracks with 26 sectors per track. Each sector holds 256 bytes.

A single-density disk has the same format but holds only one-half the number of bytes per track. Other operating systems may have greater storage capacities.

A disk lasts for approximately 3.5 million passes per track or until you put your grubby fingers on the recording surface, whichever comes first.

Sequential files can be visualized as long contiguous ribbons of information, with data recorded one piece after another. In fact, you are reading this article as a sequential file.

Sequential files use disk space more efficiently than random- or direct-access files. But, there are a number of problems associated with this type of file structure. Since they are designed to store information that will not change very often, it is difficult to make changes to the file contents.

These files are quite slow, because if you want to read a piece of data toward the end of a file, you must search through all the data from the beginning of the file until you find what you're looking for.

It is also difficult to add data to a sequential file because when you open the file as OUTPUT, you destroy its contents. You can prevent this by using a routine that copies the existing file over to another file.

It is interesting to note that some

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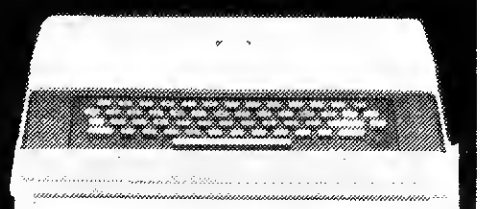

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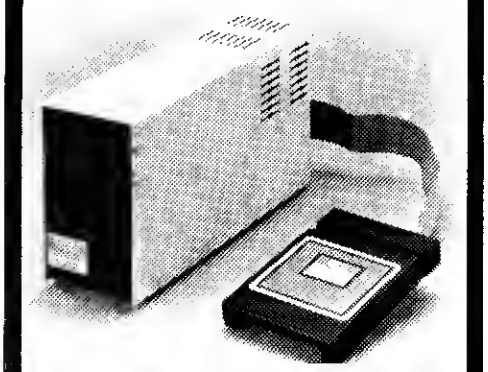

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Model I/III operating systems now allow you to open a file without destroying its contents. TRSDOS 1.3 lets you use the Open "E" option to add to the end of the file.

To create a sequential data file you must follow the word sequence exactly, otherwise you will have problems. A typical statement could be:

```
OPEN "O", 1, "SAMPLE/FIL"
```

The Open statement tells the computer which file to use. If the file does not yet exist, it creates one.

The "O" part sets the access mode for the file. "O" (output) takes information from the computer's memory and places it on the disk.

```
                SAMPLE SEQUENTIAL RECORD 1
          BYTE 1...5...10...15...20...25...30...35...40
R=1        1 ABC.
LRL=1      4440
           123D
           ........................................
```

Figure 1

```
                SAMPLE SEQUENTIAL RECORD 2
          BYTE 1...5...10...15...20...25...30...35...40
R=1        1 A                B                C.
LRL=1      422222222222222242222222222222240
           100000000000000020000000000000003D
           ........................................
```

Figure 2

"I" (input) takes information from the disk file and places it into the computer's memory. Please note that you cannot have a sequential file open for output and input at the same time.

The number 1 in the statement assigns a buffer to the file. The buffer is a section of memory that acts as temporary storage for the file contents, 256 bytes at a time. It is used for both output and input. You cannot have the same buffer open for more than one file at a time. Assign another buffer if you have more than one file open at a time. You can have up to 15 buffers open at the same time.

The name of this file is SAMPLE/FIL, but a name can be either alphabetic or a string variable. Using a string variable lets you use the same open statement for many different files.

If you use a specific name for your file, you must enclose the name in double-quotes, as in: OPEN "O", 1, "SAMPLE/FIL".

If you use a variable as the file name, it isn't necessary to use the double quotes, as in: A$="SAMPLE/FIL" OPEN"O", 1, A$.

The next line of significance, the print statement, prints data to the file through the buffer specified in the open statement.

Each item in the print list should be followed by a semicolon. This packs the data tightly into the record, where a comma places it far apart, wasting valuable disk space.

The semicolon is called a delimiter. It tells the computer that the items in the list are to be treated as a series or a string of bits or characters. This marker is not a part or member of such a series or string.

The semicolon makes sure that the data is placed properly in the file. Because the sequential file stores data in a long stream, the semicolon forces the item list to be printed in sequence with no extra spaces between each item. For example, if we say: PRINT #1, "A";"B";"C", the computer places A,B,C in the file so it would look like Fig. 1.

Notice that there are no spaces between the characters and that the last character is followed by a period. The period delimiter is placed there by the system to signify the end of the data. If you use just a comma as in PRINT #1, "A","B","C", you get the record shown in Fig. 2.

Notice the amount of wasted space; this example uses 35 bytes instead of four.

A comma can also be a delimiter. The

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explicit comma is useful for separating a number of data strings in a sequential file, such as: PRINT #1, J$;",";R$.

Quotes around the comma force a comma delimiter between the data strings and allows the information to be retrieved correctly. For instance, say that: J$ = "JOHN" and R$ = "ROGER".

Using the above statement, you print the strings to the file and the disk file looks like Fig. 3.

If you asked the computer to INPUT J$, it would know where the string ended and return JOHN to you, because the comma you forced in between the two names tells it where one ended and the other began. That saved some space; in fact it worked as well as the semicolon.

If you write a string data item with a comma in it as a valid character, such as J$ = "ROGER,JOHN", you'll need to surround the data item with explicit quotes in the print statement and then print it to the file like this: PRINT #1,CHR$(34);J$;CHR$(34), where CHR$(34) is the hexadecimal code for quotes. The quotes tell the computer to accept all the characters up to the next set of quotes as valid data.

Your file record would then look like Fig. 4.

There is one other type of delimiter often overlooked, but it is as valid as semicolons, commas, or quotes. This is the humble CHR$(13) or the carriage return that we create every time we press the enter key. The statement PRINT #1, A$;B$;C$ can also be written as:

```
PRINT #1, A$
PRINT #1, B$
PRINT #1, C$
```

Each string variable is followed by a carriage return or CHR$(13) and this is treated as a delimiter by TRSDOS. This produces a file record that looks like Fig. 5.

It should be noted that the five sample records shown above are typical of what is found in a data file if you list out the file at the TRSDOS Ready mode by typing LIST file name.

In the file above, R = 1 gives the record number and the LRL = 1 gives the length of the record. Sequential files always have a record length (LRL) of 1.

When you ask for a listing of a file, the computer numbers each record as it is listed, and prints the heading showing the relative position of each byte in the record.

After you have opened or created the file and placed your data in it, you must close the file when you have finished with it. Otherwise you may lose its contents. The close statement looks like this: CLOSE 1.

Close statements tell the computer to shut files through the same buffer used to open them. If you opened a file through buffer 2, you would say: CLOSE 2.

Program Listing 1 creates a sequential file using these lines. The program is self-documenting and does not require any action on your part to make it work. Study this listing carefully and

SAMPLE SEQUENTIAL RECORD 3

	BYTE	1...5...10...15...20...25...30...35...40
R = 1	1	JOHN,ROGER.
LRL = 1		44442544480
		AF8EC2F752D
		.....

Figure 3

SAMPLE SEQUENTIAL RECORD 4

	BYTE	1...5...10...15...20...25...30...35...40
R = 1	1	"ROGER,JOHN".
LRL = 1		2544452444420
		22F752CAF8E2D
		.....

Figure 4

```
10 REM NAME OF PROGRAM       DEMOOUT/SEQ
20 REM
30 REM AUTHOR                JESSE W. BAKER
40 REM
50 REM PURPOSE OF PROGRAM    THIS PROGRAM CREATES A SEQUENTIAL
60 REM                       FILE TO DEMONSTRATE SEQUENTIAL
70 REM                       FILE TECHNIQUES.
80 REM
90 REM DATE                  OCTOBER 10, 1982
100 '
110 '      *** OPEN THE FILE FOR OUTPUT ***
120 CLS
130 '
140 OPEN "O", 1, "SAMPLE/FIL"
150 '
160 '      *** READ DATA AND PRINT TO FILE ***
170 '
180 READ A, B, C
190 '
200 '      *** CHECK FOR END OF DATA ***
210 '
220 IF A = -9 THEN 430
230 '
240 '      *** PRINT DATA TO SEQUENTIAL FILE ***
250 '
260 PRINT #1, A; B; C
270 '
280 '      *** RETURN FOR MORE DATA ***
290 '
300 GOTO 180
310 '
320 '      *** DATA FOR READ STATEMENT ***
330 '
340 DATA 10,20,30,40,50,60
350 '
360 '      *** END OF DATA FLAG ***
370 '
380 DATA -9,-9,-9
390 '
400 '      *** CLOSE THE FILE ***
410 '
420 CLOSE 1
430 END
500 SAVE"DEMOOUT/SEQ",A
```

Program Listing 1

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follow the logic flow before you attempt to run it.

I suggest you take a disk with TRSDOS on it and type in this program. When you are at the TRSDOS Ready mode, make sure to type in: BASIC -F:2.

All TRS-80 models allow you to have either fixed-length (FLR) or variable-length (VLR) records. The command above lets you access Basic on the Model II with two file buffers open. You can then specify the length of the record in the open statement.

The procedure is different on the Model I or III. At the TRSDOS Ready mode you must type: BASIC. After you press enter, TRSDOS loads Basic and prompts: HOW MANY FILES? If you enter a number, you allow for that number of fixed-length (FLR) files. If you want to have variable-length (VLR) files, add the suffix V (for variable) to the number: 2V, for example.

When you open the file for the first time in your program, you can set the record length. But, if you attempt to run any program that accesses a data file without specifying how many files you want open, a BN ERROR message appears for attempting to access a file without preparing the system when Basic was started up.

Program Listing 2 opens and reads the data you put into the file called SAMPLE/FIL. Look at the open statement: OPEN "I" 1, "SAMPLE/FIL". It opens the file and specifies that the file be for input only; that is, the data is taken from the disk and placed into memory.

As in the previous example, you can use the same buffer because the file you want to read has been closed.

Since there is data in this file and you want to read all of it, you must now set up a check condition. This condition checks for the end of the file, EOF. You don't want the computer to attempt to read past the EOF because if it does, you get an error message: EOF ERROR in line nnn. Your check line, then, should look like this: IF EOF(1) THEN 340. Use a conditional branching statement to set up the check condition. This is followed by the expression EOF(1) which tells the computer that if the end of file is reached through Buffer 1 while it is reading the contents of the file, then it must go to line 340 and do what it says there.

Line 340 tells the computer to close the file through Buffer 1, and then to end the program.

Follow this with the statement that goes after the information in the file; since this is an input file, your line looks like this: INPUT #1, A,B,C.

The line tells the computer that you want to enter data stored under A, B, and C into the memory via Buffer 1.

You need not use the same variable names for input as you did for output. The assignment of variable names is up to you, although I do suggest you keep your names consistent if only to prevent confusion.

Another way to recall the data in a file is through the use of the statement: LINEINPUT # buffer number, variable name.

All TRS-80s can use this statement, which translates into "read a line of text from disk." This is useful when you want to read an ASCII-format Basic program file, or when you want to read in a string of data without following the restrictions regarding leading characters or delimiters. LINEINPUT # reads everything from the first character up to a carriage return character (CHR$(13)) not preceded by a line feed character, the end-of-file, or the 255th data character.

Any other delimiters encountered are included in the string. You can use this to read each line of a program that is stored in a sequential file. This works very well if you need a program to compare the contents of one file with another.

Line 260 tells the computer to print the contents of the file on the screen. This is followed by the start of a simple loop, using the unconditional branching statement, GOTO. This loop continues until all the data is read. Of course, this file must also be closed.

Program Listing 3 shows a program that lets you add additional data to an existing file. This is done by transferring the old data to a temporary file, adding the new data, and then writing the whole thing back into the original file.

```
                SAMPLE SEQUENTIAL RECORD 5
                BYTE 1...5...10...15...20...25...30...35...40
R=1             1   A.B.C.
LRL=1               404040
                    1D2D3D
                    ........................................
```

Figure 5

```
10 REM NAME OF PROGRAM       DEMOIN/SEQ
20 REM
30 REM AUTHOR                JESSE W. BAKER
40 REM
50 REM PURPOSE OF PROGRAM    THIS PROGRAM READS A SEQUENTIAL
60 REM                       FILE TO DEMONSTRATE SEQUENTIAL
70 REM                       FILE TECHNIQUES.
80 REM
90 REM DATE                  OCTOBER 10, 1982
100  '
110 CLS
120 '      *** OPEN THE FILE FOR INPUT ***
130 '
140 OPEN "I", 1, "SAMPLE/FIL"
150 '
160 '      *** CHECK FOR END OF FILE ***
170 '
180 IF EOF(1) THEN 340
190 '
200 '      *** READ DATA FROM FILE ***
210 '
220 INPUT #1, A,B,C
230 '
240 '      *** PRINT DATA FILE ON SCREEN ***
250 '
260 PRINT A,B,C
270 '
280 '      *** RETURN FOR MORE DATA ***
290 '
300 GOTO 180
310 '
320 '      *** CLOSE FILE AND END PROGRAM ***
330 '
340 CLOSE 1
350 END
360 SAVE"DEMOIN/SEQ",A
```

Program Listing 2

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You must do this with sequential files because if you open a file for output, the contents are lost.

These three programs should get you started in the right direction with sequential files. I suggest that you use these to create some programs for your own use.

Let me know if this article helped you in any way. Please enclose a self-addressed, stamped envelope for a reply, if desired. ■

Jesse W. Baker can be reached at P.O. Box 561, Old Town, ME 04468.

```
10 REM NAME OF PROGRAM       ADDDATA/SEQ
20 REM
30 REM AUTHOR                JESSE W. BAKER
40 REM
50 REM PURPOSE OF PROGRAM    THIS PROGRAM ALLOWS YOU TO ADD DATA
60 REM                       TO AN EXISTING SEQUENTIAL DATA FILE.
70 REM
80 REM DATE                  OCTOBER 10, 1982
90 REM
100 CLS
110 '
120 '     *** GET FILE NAME ***
130 '
140 INPUT"ENTER THE NAME OF THE FILE YOU WISH TO ADD DATA TO";A$
150 OPEN "I", 1, A$
160 OPEN "O", 2, "TEMPFIL"
170 '
180 '     *** FILE COPY ROUTINE ***
190 '
200 GOSUB 560
210 '
220 '     *** DATA ENTRY ROUTINE ***
230 '
240 INPUT"ENTER NUMBER OF ITEMS YOU WISH TO ENTER";N
250 PRINT
260 FOR X = 1 TO N
270 :    PRINT"ITEM # ";X;" ==>";:INPUT A
280 :    PRINT #2,A
290 NEXT X
300 '
310 '     *** CLOSE FILES ***
320 '
330 CLOSE 1,2
340 '
350 '     *** REOPEN FILES ***
360 '
370 OPEN "I", 1, "TEMPFIL"
380 OPEN "O", 2, A$
390 '
400 '     *** FILE COPY ROUTINE ***
410 '
420 GOSUB 560
430 '
440 '     *** CLOSE FILES AGAIN ***
450 '
460 CLOSE 1,2
470 PRINT"FILE COPY COMPLETE"
480 '
490 '     *** END PROGRAM ***
500 '
510 END
520 '
530 '     *** FILE COPY SUBROUTINE  ***
540 '     *** COPY FILE 1 TO FILE 2 ***
550 '
560 IF EOF(1) THEN RETURN
570 INPUT #1, A
580 PRINT #2, A;
590 GOTO 560
600 SAVE"ADDDATA/SEQ",A
```

Program Listing 3

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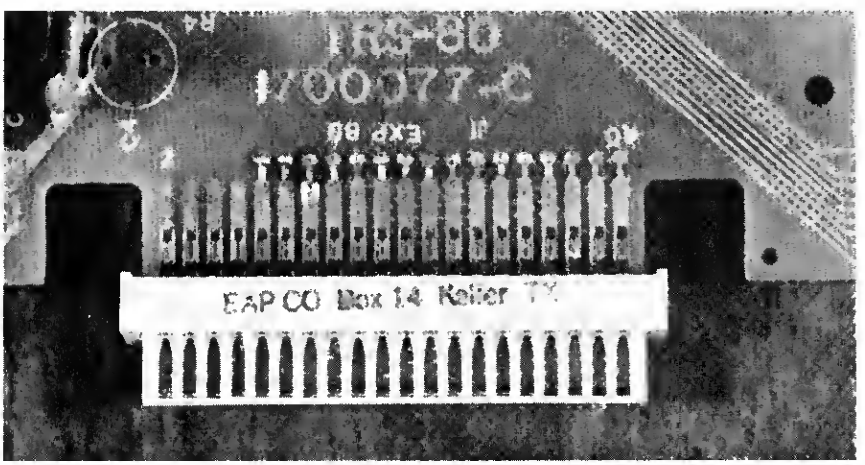
Ahhhh, instant relief! At last there is a permanent cure for contact oxidation on Model I edge connectors. Many TRS-80 users are familiar with the symptoms: untimely resets, spontaneous reboots, or the inability to get the computer started at all without a frustrating session with a pink eraser.

The Gold Plug 80 is a well made device consisting of an edge-card plug with gold plated contacts, available with either 34 or 40 contacts. The rear of the plug has terminal tabs which fit exactly over the existing foil fingers on the TRS-80's connectors. After installation, the original plugs have been extended about a half inch, meaning that the plastic door covers no longer fit. This did not trouble me, but you should take it into consideration. E.A.P.'s advertising leaflet, by the way, cautions you about the doors, which is refreshing. They also have the excellent policy of permitting you to return any plugs ordered for a refund if after seeing them you are unwilling to undertake the installation.



The Gold Plug 80

An excellent set of instructions accompany the plugs, and they are shipped promptly. I ordered mine by mail on a Monday and received my set of plugs by first class mail on Tuesday of the next week.

Installation

Installation requires a soldering iron (I use a 40-watt Weller), Rosin-core solder, a Phillips screwdriver, and your last Pink Pearl. The keyboard and Expansion Interface have to be disassembled to get at the connectors, which are then cleaned—the eraser's last fling. The Gold Plug 80 is fitted over the existing plug with the contacts centered, and then soldered to the board. I have some soldering experience, but it proved to be an easy, safe job. The contact is heated, a very small amount of solder applied, and then you go on to the next contact. It took about an hour to do all six plugs.

If you are a little nervous about this kind of work, note that all the contacts on the underside of the RS-232 output connector are grounded—that is, they are all connected. Start there; you can do no harm and the practice will be helpful.

The Gold Plug 80 set I bought included all six plugs. The plugs are available individually for $9.95, or you can get a pair for the keyboard to Expansion Interface cable for $18.95.

As I said earlier, I did resolder every connector on the machine, and I haven't had a single unwanted reset since. ■

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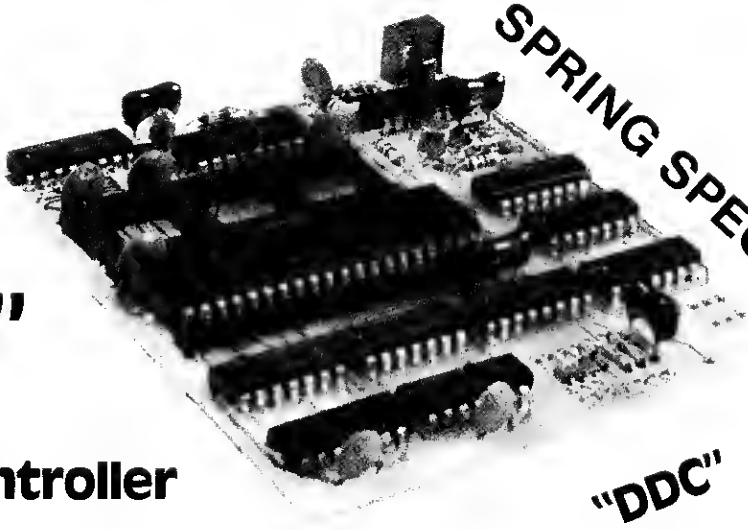

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The test consisted of formatting 40 tracks on the diskette and writing a 6DB6 data pattern on all tracks. The 6DB6 pattern was chosen because it is recommended as a "worst case" test by manufacturers of drives and diskettes. An attempt was then made to read each sector on the disk once - no retrys. Operating system was Newdos/80, Version 1.0, with Double Zap, Version 2.0. Unreadable sectors were totalled and recorded. The test was run ten times with each double density controller and the data averaged. Test results are shown in the table.

★ Features

TRS80 Model I owners who are ready for reliable double density operation will get (1) 80% more storage per diskette, (2) single and double density data separation with far fewer disk I/O errors, (3) single density compatibility and (4) simple plug-in installation. Compatible with all existing double density software.

★ Value $139.95

for the Best DD Controller on the market.

SPRING SPECIAL
"DDC" and LDOS $189.95

$169.95 for "DDC" with DOSPLUS 3.30

★ TEST RESULTS ★

MFR & PRODUCT	SECTORS LOCKED OUT (AVG)
AEROCOMP "DDC"	0
PERCOM "DOUBLER II"	18
PERCOM "DOUBLER A"	250
LNW "LNDOUBLER"	202

Note: test results available upon written request. All tests conducted prior to 8-25-81

Aerocomp's 14 day money back guarantee applies to hardware only.
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The advances that make the "DDC" great are incorporated in the new AEROCOMP Single Density Data Separator ("SDS") and Double Density Data Separator ("DDS").

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If you already own a Percom "Doubler A", "Doubler II" or LNW "LNDoubler" or Superbrain, the AEROCOMP "DDS" will make it right. Look at the test results:

MFR. & PRODUCT	SECTORS LOCKED OUT	
	WITHOUT "DDS"	WITH "DDS"
PERCOM "DOUBLER II"	18	1
PERCOM "DOUBLER A"	250	0
LNW "LNDOUBLER"	202	0

Note: Same test procedures as "DDC".
* Trademark of Percom Data Co.
** Trademark of LNW
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★ "DDS" $49.95

(Use 1791 chip from your DD Controller)

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Plugs directly into your existing Double Density Controller.

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(For Mod. I; shipping $2.00)

See opposite page ▸▸▸▸▸▸

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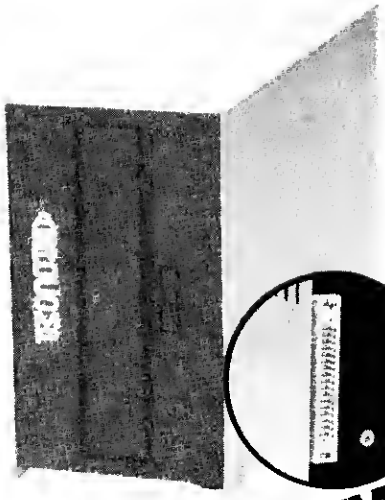

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- ★ 40 track Dual Head $279
- ★ 80 track SS $299
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- ★ 80 track Dual Head $379
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- ★ 80 track Dual Head . . . . . $339 (add $20 for "Flippy" modification)
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Model II Real-World Input/Output

by J.J. Barbarello

This Model II capacitance meter lets your computer communicate with the outside world. It's inexpensive and simple to build, too.

Most people think of the TRS-80 Model II solely as a business machine. Trading up from a Model I implies that you give up all thought of interfacing with the outside world. But you'll see this is far from the case.

It's true that the Model II doesn't have the Model I's now-famous audio cables that allow you to connect it to almost anything. But it does have something just as good (or better).

The Model II's I/O (input/output) facility is its line printer port. You might consider the parallel printer port as just a way to get a printout, but to the Model II it's just another I/O port.

This article describes the construction of a computerized Capacitance Measuring Interface (CMI), a device that assures the appropriate I/O electrical signals come from and go to the computer.

The CMI measures capacitors as low as one picofarad or as high as 20 microfarads. Add to that the computer's capability to store results, use measured values in computer-aided design, and perform go-no go testing and you have capabilities that cost thousands of dollars on today's market.

For those of you with an interest in electronics as well as computers, a capacitance meter is an invaluable piece of test gear. You probably don't own one, however, because you wouldn't use it enough to justify its cost. Like me, you probably select a marked capacitor and hope that its true value isn't too far off.

The Capacitance Measuring Interface changes all that. When you complete this project, you'll have an important, useful test instrument as well as an understanding of how to interface your Model II to the outside world.

Measuring Capacitance

The standard capacitance measuring scheme determines the time needed for an unknown capacitor to charge to a predetermined level. This time is then converted into a capacitance value.

The CMI uses the same principle. If you connect a 555 Timer IC as shown in Fig. 1 and trigger it with a negative-going pulse, pin 3 immediately rises to the supply voltage (V+). It stays at V+ for a time equal to $1.0986 \times (C_X) \times R$ seconds. This time is independent of supply voltage and, if R is constant, is always the same for a given capacitor. We then determine C_X by accurately measuring the length of the positive pulse present at pin 3 (since C_X = duration of pulse/$(1.0986 \times R)$).

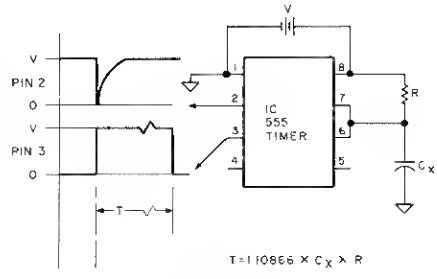

Figure 1

The CMI Circuit

Referring to the CMI schematic in Fig. 2, notice that IC1 is a 555 Timer IC connected like the one in Fig. 1. The duration of IC1's output pulse depends on C_X and the value of the timing resistor R3 or R4 (selected by rotary switch S1a). IC2 remains unaffected by the positive transition of IC1's output. But when the pulse from IC1 ends, this negative transition is transmitted through C1 and triggers IC2. As a result, IC2 produces a fixed-duration, positive-going pulse to J2.

In review, IC1's output pulse starts when a positive-going trigger is provided to Q1 (since the trigger is inverted by Q1 and turns on IC1). Also, you can tell when IC1's output has ended by the presence of a positive pulse at J2. All you need do now is have the computer provide the trigger pulse and count until it senses a pulse at J2.

The Key Box

Model II
32K RAM
Basic, Assembly Language Editor/Assembler or Debug

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- RS-232 interface to Model I/III or other types of computers.
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SOFTWARE:

- Register functions under control of a master computer such as a TRS-80 Model I/III or a THOR Local Area Network.
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- Optional automatic entry of sales into a general ledger system.
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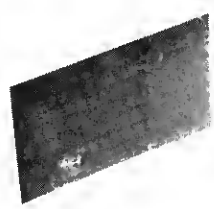

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- Disk capacity of up to 40 megabytes or more for your Model I/III computer. Available in fixed and/or removable drive versions.
- External mounting in a two-drive case as shown or internal mounting.
- Each THOR System comes with a two drive controller and interface to your Model I/III.
- Software available includes an optional operating system (LDOS or NEWDOS-80) and diagnostics.
- The THOR Local Area Network can be field installed. (See below).

THOR Winchester Disk Drive System from $1299

THOR LOCAL AREA NETWORK (LAN)

A new concept is emerging. An LAN now makes it possible for the smallest business or school to have multi-processing with shared access of common files on a Winchester disk.

The THOR LAN extends this concept. The THOR LAN allows the use of various microcomputers which you already own so that your present investment is not made obsolete. Hardware/software interfaces are available for TRS-80, Apple and Atari. IBM and Commodore are coming soon. The THOR LAN can support up to 254 users with over 4,000 feet of cabling. Ten conductor ribbon cable allows easy addition of new computers. Speeds of up to one megabit per second are possible. File protection is available with multiple users having the option to access any authorized information.

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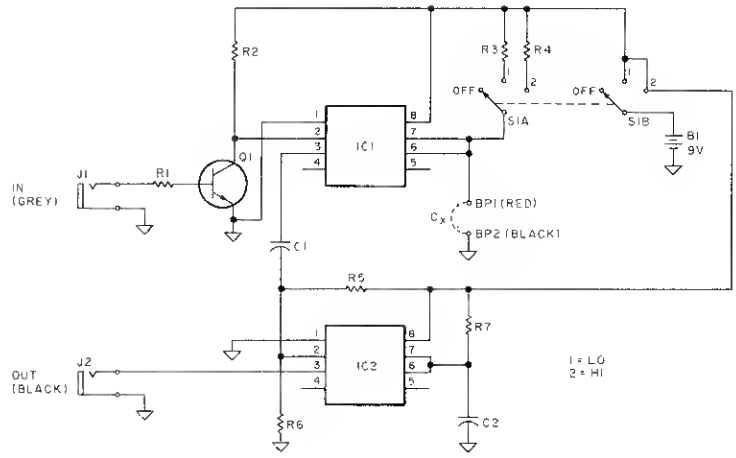

Figure 2

Power for the circuit is provided by a 9-volt battery. S1b acts as a power-on switch, providing power to the circuit when S1 is in position 1 or 2 and disconnecting the battery when S1 is in the OFF position.

The Computer's Part

Do you remember those wonderful commands In and Out from the Model I? They're alive and well as part of the Model II's Z80 instruction set. However, instead of using them on port #255 as we did on the Model I, we use port E0H (244 decimal). Port E0H is the parallel printer channel port to which we can output and (to a limited extent) input data. Use the prime signal to trigger the CMI. Normally the prime signal resets certain printers, but it can trigger any external device.

Input signals such as busy, acknowledge, or fault sense when the CMI completes its task (see the Model II Technical Reference Manual for a complete description of the printer/floppy disk controller). However, the CMI is arbitrarily designed to trigger the paper empty pin to inform the computer that its task is complete.

So, by connecting J1 of the CMI to the prime pin and J2 to the paper empty pin, you can trigger the CMI and then sense when it has completed its task. All that's left to do is count the time in between and convert that time to a capacitance value. Generating the prime signal, sensing the paper empty signal, and counting and conversion are all controlled by the CMI program.

Two Programs in One

The Basic langnage CMI Driver pro-

(NOTE: All resistors are 1/4 watt, 10 percent. All capacitors are 10 V or greater disc.)
R1, R2, R5, R6, R7.... 10k Ohms
R3 ..... 10 Megohms
R4 ..... 100k Ohms
C1 ..... 0.01 μF
C2 ..... 0.1 μF
IC1, IC2 ..... 555 Timer IC
Q1 ..... 2N2222A or PN2222 NPN silicon transistor
J1, J2 ..... 1/8 inch phono jack
S1 ..... 2 pole, 6 position rotary switch
B1 ..... 9 V battery clip
BP1 ..... Red 5-way binding post
BP2 ..... Black 5-way binding post
Miscellaneous: P.C. board, interconnecting cable, control knob, hookup wire, suitable case.
Note: A complete kit of all items listed above plus the CMI programs and a Computer Aided 555 Timer Design program on disk is available for $39.95 from the author. Please specify kit #CMI-IID. NJ residents include sales tax.

A version of the CMI is available for Model I/III. Contact the author for further details.

Table 1. List of Materials

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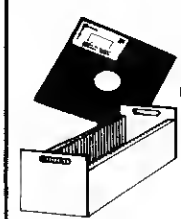

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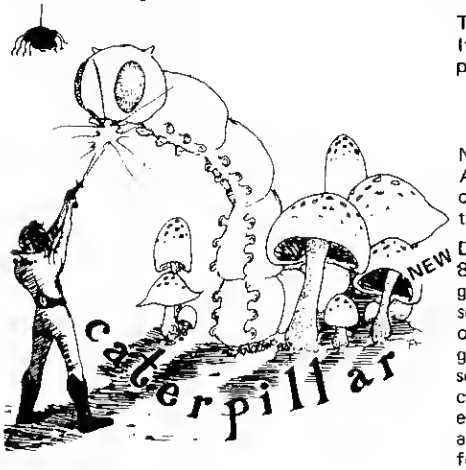
Adds a second level with dungeons and more Questing.



CATERPILLAR
O.K., the Caterpillar does look a lot like a Centipede. We have spiders, falling fleas, monsters traipsing across the screen, poison mushrooms, and a lot of other familiar stuff. COLOR 80 requires 16k and Joysticks. This is Edson's best game to date. $19.95 for TRS 80 COLOR.

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The Adventures below are written in BASIC, are full featured, fast action, full plotted adventures that take 30-50 hours to play. (Adventures are interactive fantasies. It's like reading a book except that you are the main character as you give the computer, commands like "Look in the Coffin" and "Light the torch.")

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NEW
PLANET RAIDERS – Not just another defenders copy, this is an original program good in its own right. You pilot a one man ship across a planetary surface dogfighting with alien ships and blasting ground installations while you rescue stranded troopers. Rescue all the troopers and be transported to another harder, faster battle. Joysticks required. ALL MACHINE CODE! EDSONS BEST! 16K Tape TRS80COLOR $19.95 – 32K Disk $21.95.

BASIC THAT ZOOMMS!!
AT LAST AN AFFORDABLE COMPILER!
The compiler allows you to write your programs in easy BASIC and then automatically generates a machine code equivalent that runs 50 to 150 times faster.

It does have some limitations. It takes at least 8k of RAM to run the compiler and it does only support a subset of BASIC– about 20 commands including FOR, NEXT, END, GOSUB, GOTO, IF, THEN, RETURN, END, PRINT, STOP, USR (X), PEEK, POKE, *, /, +, -, >, <, =, VARIABLE NAMES A-Z, SUBSCRIPTED VARIABLES, and INTEGER NUMBERS FORM 0-64K.

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Program Listing 1

```
1 REM**          CMI DRIVER PROGRAM
2 REM**          NAME: CMI
3 REM**          LATEST REVISION: #3, 16 Jan 1982
4 REM**
10 CLS:CLEAR 1000:SYSTEM"LOAD MODIICMI":DEFUSR4=&HF050:DEFUSR5=&
HF07C
20 DEFSTR A,N,R:A=CHR$(26)+" "+CHR$(25):N=CHR$(25):R=CHR$(26):AB
=" ":ALN=R+STRING$(80,32)+R
30 PRINT CHR$(154);STRING$(78,150);CHR$(154);:PRINT A;TAB(24);R;
" COMPUTERIZED CAPACITANCE METER ";N;TAB(79);A;
40 FOR I=1 TO 2:PRINT A,TAB(79);A;:NEXT:PRINT R;CHR$(153);N;STRI
NG$(78,150);R;CHR$(153);N
50 PRINT@(8,0),ALN:PRINT@(16,0),ALN;:FOR I=9 TO 15:PRINT@(I,0),A
:PRINT@(I,79),A;:NEXT
60 PRINT@(12,35),"METER ON":PRINT@(9,2),"R":PRINT@(10,2),"A":PRI
NT@(11,2),"N":PRINT@(12,2),"G":PRINT@(13,2),"E"
70 PRINT@(2,3),STRING$(74,151):PRINT@(3,7),"Press ";R;" 1 ";N;"
for LO range, ";R;" 2 ";N;" for HI range, or ";R;" F1 ";N;" to t
urn Meter OFF."
80 VR(1)=11.07:VR(2)=.0972:Z(1)=15:Z(2)=1:MULT=47222:GOTO 280
90 REM**         INITIALIZATION COMPLETED - PROGRAM BEGINS
**
100 PRINTCHR$(2):X=USR4(0):PRINTCHR$(1):IF X<0 THEN X=65536+X
110 X=X-Z(RNG%):IF X>0 THEN GOSUB 2200:GOTO 150
120 GOSUB 2200:PRINTCHR$(2):FOR I=1 TO 10:PRINT@(12,30),"<< OUT
OF RANGE >>";
130 FOR J=1 TO 50:NEXT:PRINT@(12,30),SPACE$(20);:FOR J=1 TO 50:N
EXT J,I
140 PRINT@(12,30),CHR$(1);"<< OUT OF RANGE >>";:GOTO 280
150 D#=X/(VR(RNG%)*MULT)+9999999999:CV=X/(VR(RNG%)*MULT):IF RNG%
<>1 THEN 220
160 LO=LEN(STR$(INT(VR(1)*MULT*.1/X)))+1:Y$=MID$(STR$(D#),13,LO)
170 IF LO=7 THEN LO=6
180 R%=10:C=8:GOSUB 2000:C=C+7
190 FOR F=1 TO LO:J=VAL(MID$(Y$,F,1))
200 ON J+1 GOSUB 1000,1100,1200,1300,1400,1500,1600,1700,1800,19
00
210 C=C+7:NEXT F:GOSUB 2100:GOTO 280
220 IF RNG%=2 THEN NV=MID$(STR$(CV),2,5)
230 IF CV<1 THEN NV="0"+LEFT$(NV,4) ELSE NV=LEFT$(NV,4)
240 IF LEN(NV)<4 THEN NV=NV+"0"
250 R%=10:C=20:FOR F=1 TO 4:Z=ASC(MID$(NV,F,1))-47:Z=Z+(Z=-1)*-1
2
260 ON Z GOSUB 1000,1100,1200,1300,1400,1500,1600,1700,1800,1900
,2020
270 C=C+7:NEXT:GOSUB 2100
280 PRINT@(19,35),"RANGE ?...";CHR$(23);:RI=INPUT$(1)
290 IF ASC(RI)=1 THEN PRINT" OFF":X=USR5(0):GOSUB 2200:PRINT@(12
,35),"METER OFF.":PRINT@(20,0),;:END
300 RNG%=VAL(RI):IF RNG%<>1 AND RNG%<>2 THEN 280
310 PRINT R;" MEASURING ";N:PRINT@(15,1),RNG%;:IF ROLD%<>RNG% TH
EN X=USR4(0):ROLD%=RNG%
320 GOTO 100
330 REM**
340 REM********************     DISPLAY SUBROUTINES      ********
***************
350 REM**
1000 REM** ZERO
1010 PRINT@(R%,C),CHR$(154);A;A;A;A;CHR$(154):FOR I=1 TO 3:PRINT
@(R%+I,C),A;AB;AB;AB;AB;A:NEXT I:PRINT@(R%+4,C),R;CHR$(153);N;A;
A;A;A;R;CHR$(153);N:RETURN
1100 REM**       ONE
1110 PRINT@(R%,C+1),CHR$(146):FOR I=0 TO 4:PRINT@(R%+I,C+2),A;A:
NEXT:PRINT@(R%+4,C+1),A;A;A;A:RETURN
1200 REM**       TWO
1210 PRINT@(R%,C),A;A;A;A;A;A:PRINT@(R%+1,C+5),A:PRINT@(R%+2,C),
A;A;A;A;A;A
1220 PRINT@(R%+3,C),A:PRINT@(R%+4,C),A;A;A;A;A;A:RETURN
1300 REM**       THREE
1310 PRINT@(R%,C),A;A;A;A;A;A:PRINT@(R%+1,C+5),A:PRINT@(R%+2,C+1
),A;A;A;A:PRINT@(R%+3,C+5),A:PRINT@(R%+4,C),A;A;A;A;A;A:RETURN
1400 REM**       FOUR
1410 PRINT@(R%,C),A;A;AB;AB;A;A:PRINT@(R%+1,C),A;A;AB;AB;A;A:PRI
NT@(R%+2,C),A;A;A;A;A;A:PRINT@(R%+3,C+4),A;A:PRINT@(R%+4,C+4),A;
A:RETURN
1500 REM**       FIVE
1510 PRINT@(R%,C),A;A;A;A;A;A:PRINT@(R%+1,C),A:PRINT@(R%+2,C),A;
A;A;A;A;A:PRINT@(R%+3,C+5),A:PRINT@(R%+4,C),A;A;A;A;A;A:RETURN
1600 REM**       SIX
1610 PRINT@(R%,C),A;A:PRINT@(R%+1,C),A;A:PRINT@(R%+2,C),A;A;A;A;
A;A:PRINT@(R%+3,C),A;A;AB;AB;AB;A:PRINT@(R%+4,C),A;A;A;A;A;A:RET
URN
1700 REM**       SEVEN
1710 PRINT@(R%,C),A;A;A;A;A;A:FOR I=1TO4:PRINT@(R%+I,C+4),A;A:NE
XT:RETURN
1800 REM**       EIGHT
1810 FOR I=0 TO 5 STEP 2:PRINT@(R%+I,C),A;A;A;A;A;A:NEXT:FOR I=1
```

Listing 1 continues

gram (Program Listing 1) performs many of the required functions. The input and output signals, as well as the intermediate count, are performed by a machine-language program. This program, "MODIICMI" loads by line 10 of the Basic program, which also defines its entry point (0F050H). The assembled program (fully commented) is in Program Listing 2. Essentially, the program sends a prime signal to the CMI. It then enters a loop and senses the paper empty pin, increments the count if the PE pin is low, then waits and tries again. When the PE pin is sensed high (line 220) or the maximum count has been reached (line 240), execution jumps out of the loop. At this point, the count is transferred to the Basic variable and a return is performed.

During non-CMI applications, the prime pin is at a logic level 1. During CMI operation, the prime pin stays low (except for the trigger pulse). When you finish using the CMI and wish to use the parallel printer channel for the line printer, return the prime pin to the logic 1 level using lines 370 and 380 of the machine-language program. This short routine (defined as USR5 in the Basic program's line 10) is called just before the program ends at line 290.

"A capacitance meter is an invaluable piece of test gear."

The majority of the Basic program deals with screen formatting and measured value display. The screen's presentation simulates a meter with a large LCD (Liquid Crystal Display) readout. Line 70 prints a message on the screen prompting you to press 1 for the LO range, 2 for the HI range and F1 to turn the meter off.

Construction

A printed circuit (PC) board is required to maintain the accuracy of the CMI. Fabricate the PC board using the pattern shown in Fig 3a. Then begin mounting the components and jumper J1, paying special attention to the orientation of IC1, IC2 and Q1 (see Fig 3b). Next, mount and connect J1, J2, BP1,

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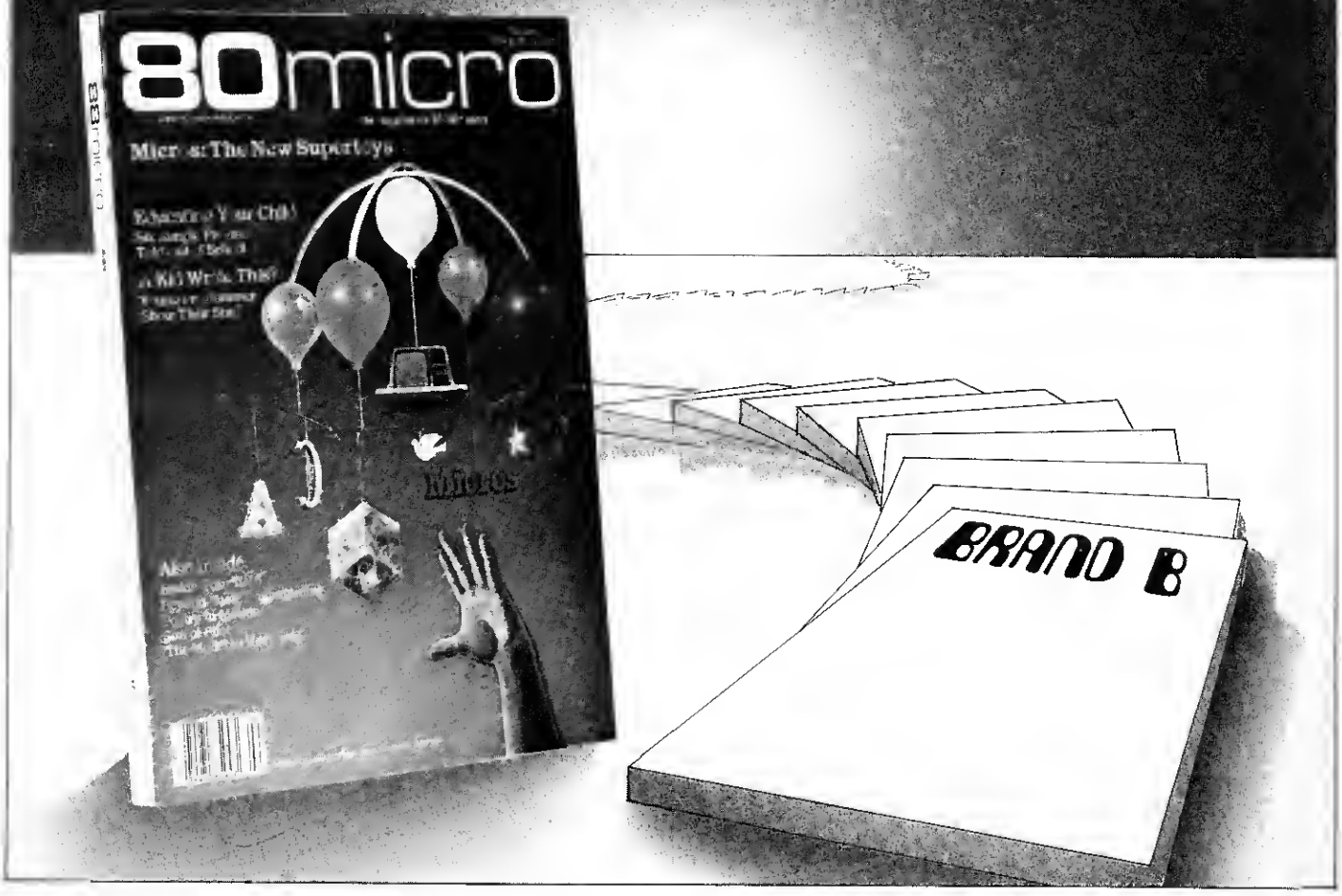

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Listing 1 continued

```
 TO 3 STEP 2:PRINT@(R%+I,C),A;AB;AB;AB;AB;A:NEXT:RETURN
1900 REM**       NINE
1910 PRINT@(R%,C),A;A;A;A;A;A:PRINT@(R%+1,C),A;AB;AB;AB;A;A:PRIN
T@(R%+2,C),A;A;A;A;A;A:PRINT@(R%+3,C+4),A;A:PRINT@(R%+4,C+4),A;A
:RETURN
2000 REM**       LEADING ZERO
2010 GOSUB 1000:C=C+7
2020 PRINT@(R%+4,C+2),A;A:RETURN
2100 REM**       uF
2110 PRINT@(R%+3,C),A;AB;A:PRINT@(R%+4,C),A;CHR$(153);A
2120 PRINT@(R%+1,C+4),A;A;A:PRINT@(R%+2,C+4),A:PRINT@(R%+3,C+4),
A;R;CHR$(153);N:PRINT@(R%+4,C+4),A:RETURN
2200 REM**       CLEAR DISPLAY
2210 PRINTCHR$(2)
2220 FOR I=10 TO 15:PRINT@(I,5),STRING$(70,32);:NEXT
2230 PRINTCHR$(1):RETURN
```

```
                00010          ;*********************************************
                00020          ;*       SOURCE=MODIICMI/ASM - OBJ=MODIICMI   *
                00030          ;*       Version 1.1          9 Jan 1982      *
                00040          ;*            c 1982 by J.J. Barbarello      *
                00050          ;*       Capacitance Measuring Interface      *
                00060          ;*       Machine Language Driver. For use     *
                00070          ;*       with CMI Hardware.                   *
                00080          ;*                                            *
                00090          ;*********************************************
F050            00100          ORG     0F050H
F050 3E81       00110          LD      A,129   ;TURN OFF
F052 D3FF       00120          OUT     (255),A ;  REAL TIME CLOCK.
F054 2295F0     00130          LD      (0F095H),HL;Save HL counter
F057 210000     00140          LD      HL,0    ;Initialize
F05A 110100     00150          LD      DE,1    ;  Registers.
F05D 3E00       00160          LD      A,0     ;Send A pulse
F05F D3E0       00170          OUT     (0E0H),A;  To the Line Printer's
F061 3E08       00180          LD      A,8     ;  "PRIME" Pin (# 26),
F063 D3E0       00190          OUT     (0E0H),A;  (PRIME Stays at Logic 1).
F065 DBE0       00200 LOOP     IN      A,(0E0H);Get status of "Printer".
F067 CB77       00210          BIT     6,A     ;Check Bit 6 ("Paper Empty")
F069 2009       00220          JR      NZ,DONE ;If set, jump to "DONE".
F06B 19         00230          ADD     HL,DE   ;Increment HL-Counter.
F06C 3806       00240          JR      C,DONE  ;If Count>FFFFH, Return.
F06E 0602       00250          LD      B,2     ;Must delay here so count
F070 10FE       00260 WAIT     DJNZ    WAIT    ;  is not too high!
F072 18F1       00270          JR      LOOP    ;Not done yet. Go back.
F074 EB         00280 DONE     EX      DE,HL   ;Save count in DE.
F075 2A95F0     00290          LD      HL,(0F095H);Get addr of variable.
F078 73         00300          LD      (HL),E  ;Put Count LSB in variable.
F079 23         00310          INC     HL      ;Get ready for MSB.
F07A 72         00320          LD      (HL),D  ;Put Count MSB in variable.
F07B C9         00330          RET             ;Return to BASIC program.
                00340          ;
                00350          ;<< RESTORE PROPER "PRIME" LOGIC LEVEL >>
                00360          ;
F07C 3E00       00370          LD      A,0
F07E D3E0       00380          OUT     (0E0H),A
F080 C9         00390          RET
0000            00400          END
```

Program Listing 2

BP2, S1 and B1 as shown in Fig. 3c.

Place S1 to the off position and snap a 9-volt battery into B1. Mount the completed CMI in any suitable case or use it as is. Finally, mount a suitable control knob on S1, positioning the marker at the off position.

With the CMI complete, you must fabricate a connecting cable. The cable consists of two 1/8-inch phono plugs at one end, a 34-pin female header (made from AP Products', part number 929975) at the other, and a three-conductor cable interconnecting them as shown in Fig. 4. When the connecting cable is made, your CMI is complete.

Using the CMI

Enter the machine-language program (with an Editor/Assembler or the TRSDOS Debug facility). Save this program under the name "MODIICMI". Now enter and save the Basic program using the name "CMI". Type RUN"CMI" and press enter. After a short time, the screen clears and the CMI meter appears on the screen.

Now attach the connecting cable to the parallel printer channel and the CMI. Obtain a marked, known-value capacitor of about 0.1 μF and attach it to the CMI binding posts. Place the range switch to the LO position. At the bottom of the screen you should see the prompt RANGE?.... Press the I key. Immediately after the prompt, you should see "MEASURING" in reverse video. After some time, the measured value appears in the display above the prompt (EX: 0.094 μF). Place the range switch to HI and press 2 on the keyboard. Again, "MEASURING" appears. Next, the previous measurement disappears and is replaced by the new

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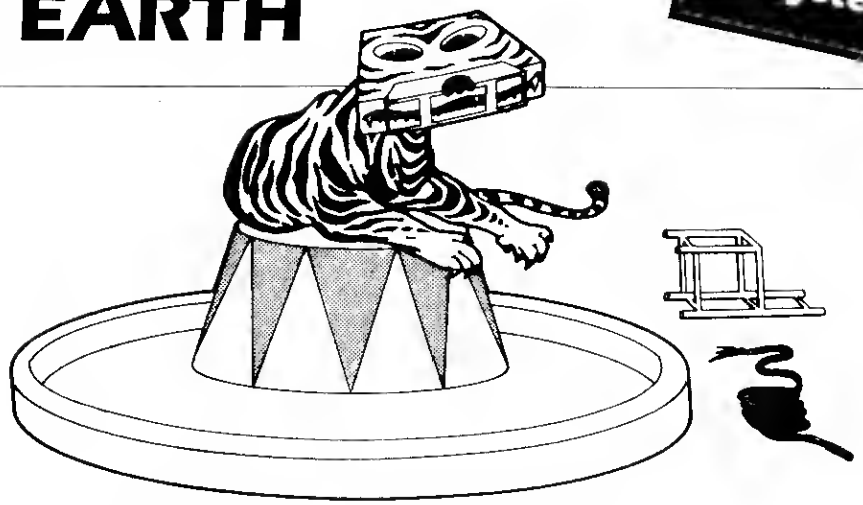

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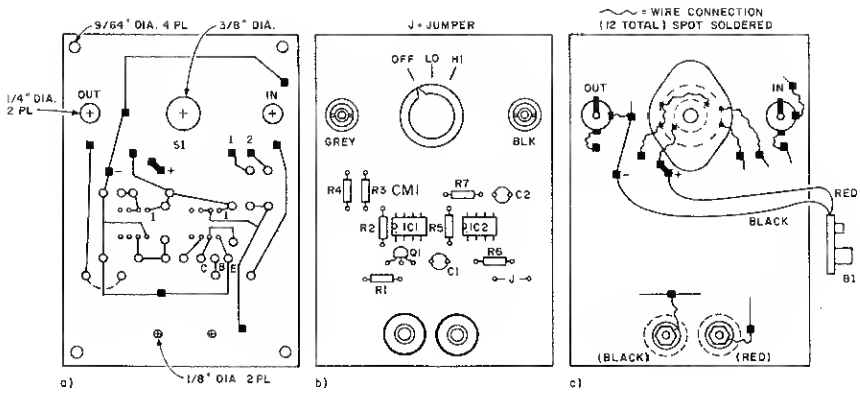

Figure 3

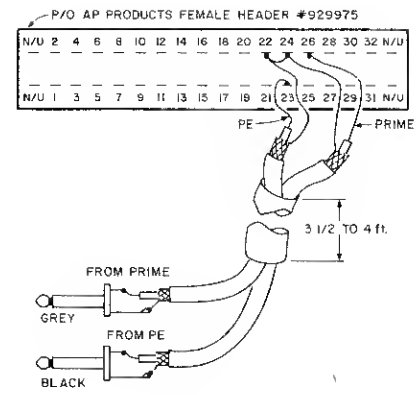

Figure 4

measured value (EX: 0.09 μF).

At this point, try measuring any other capacitors you wish. You must adhere to two rules, however. First, always press the number corresponding to the range set for the CMI. For instance, pressing 2 when the CMI is set to the LO range results in an erroneous reading. Second, when measuring polarized capacitors (such as electrolytes), always connect the positive (+) lead to the red binding post and the negative (−) lead to the black binding post.

If you attempt to measure a capacitor that is larger or smaller than the selected range, the message <OUT OF RANGE> blinks in the display area. Simply change ranges and try again. If the <OUT OF RANGE> message appears after trying both ranges, the capacitor is either larger than 20 μF, or is defective.

When you finish with the meter, place the range switch to the off position and press the keyboard's F1 key in response to the screen's RANGE?... prompt. The display area clears, the message "METER OFF" appears and the program ends.

Calibration

Calibration corrects the CMI circuit's stray capacitances and deviation from nominal values of R3 and R4. All factors to be calibrated are contained in line 80.

To begin calibration, enter the following: 105 PRINT@(22,0),"FACTOR=";X. Run the program with the CMI on the LO range (#1) and no capacitor connected. Press 1 for "RANGE?..." and the factor indicated (<OUT OF RANGE> appears). This is Z(1). Repeat for the HI range (#2). The factor that appears is Z(2). Now measure R3 (EX: 10.9 megohms). This is VR(1) (EX: 10.9). Repeat, measuring R4 (EX: .0973 megohms) which

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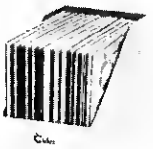

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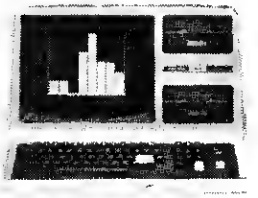

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is VR(2). Modify the present line 80 values of Z(1), Z(2), VR(1), and VR(2). Delete line 105 and save the program.

Place the range switch to the off position when the CMI is not in use to extend the battery life.

You may want to program your own application (such as go-no go testing, computer-aided design, and data retention on disk file) using the CMI. The basic procedure is short and simple.

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J.J. Barbarello lives at R.D. #1, Box 241H Tennent Road, Englishtown, NJ 07726.

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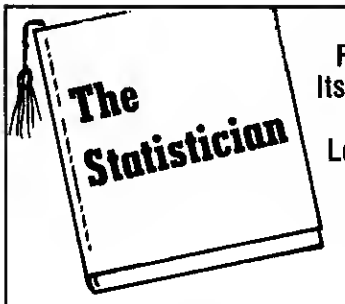

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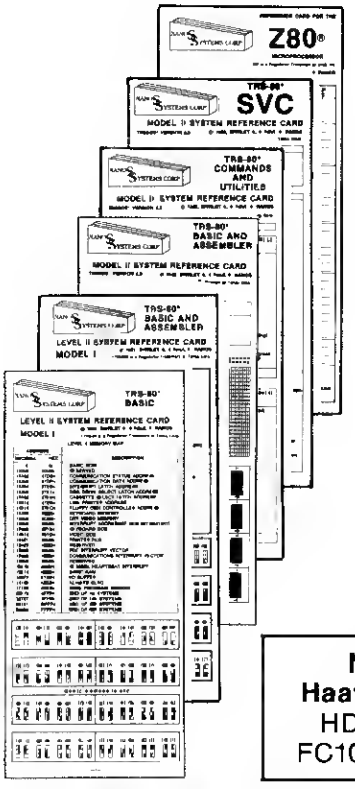

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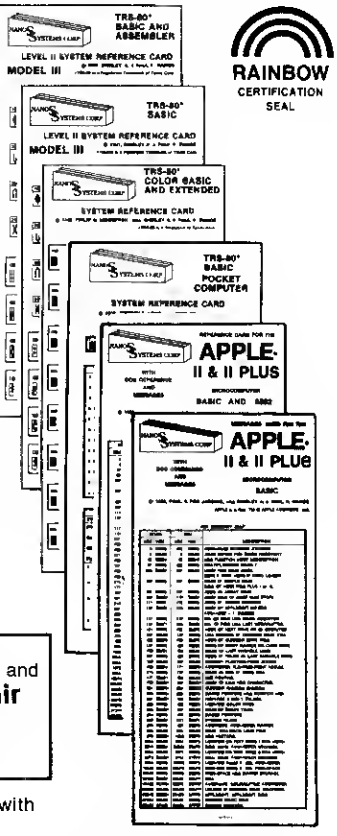

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Reproduce finer shading levels.

The Printer as a Paintbrush—Part II

Mike Keller
13423 Desert Hills NE
Albuquerque, NM 87111

In Part I of this series (May 1983, p. 218) we learned to digitize block letters and line drawings, and reproduced images on two printers with dot-addressable graphics. Because these images were black and white, our computer just needed to know whether an individual point on the graph was "on" or "off." Dark squares on the original image were represented as dots on the printout, and white squares were not printed at all. Digitizing a photograph, however, is not as cut and dried. A photograph consists of many levels of shading, from white to grey to black.

Part II will consider the problem of reproducing several shading levels, so you can print a fairly close representation of a photo on your printer. Photo 1 shows a sample of the results you may expect. The printout was digitized from an 8 by 10 photograph. Also included in this part is a short Basic program that generates a miniature TRS-80 screen-print.

Photo 1. Digitized 8 by 10 photograph

System Requirements

Other than a printer with dot-addressable graphics, no special hardware is needed to use the programs shown here. The programs were developed on a TRS-80 Model I with Disk Basic and 48K memory, but should work with 32K as well. As with the listings from last month, each program is shown in two versions: one for the NEC 8023 printer, and one for the Epson MX-80 with Graftrax 80 installed. The routines shown for the NEC should work on the C.ITOH 8510 or the ADS 8001.

Here's how we will approach digitizing a photo: First, several dot matrix patterns will be developed that produce different levels of shading when printed. Then we will divide the photo into small squares, and build data statements that contain a series of digits. Each digit will represent the shading level which best approximates that of a given square in the original photo. A program will then read the data and send it to the printer as a series of shading levels.

Decisions, Decisions

Several considerations must be balanced against one another when setting up our

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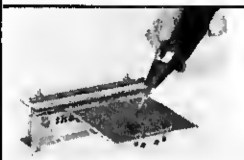

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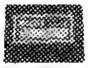

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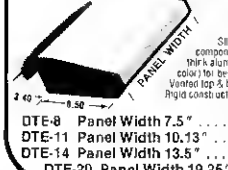

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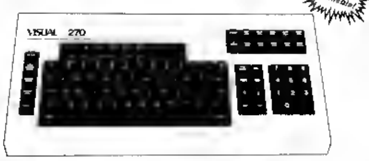

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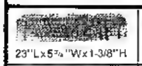

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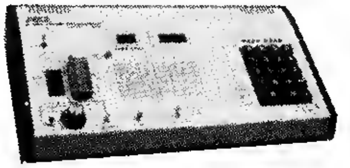

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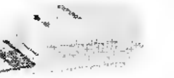

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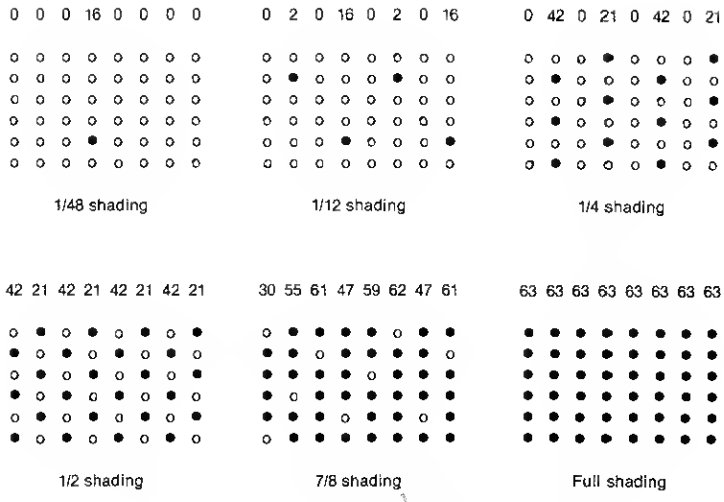

Fig. 1. Shading level dot patterns for the NEC

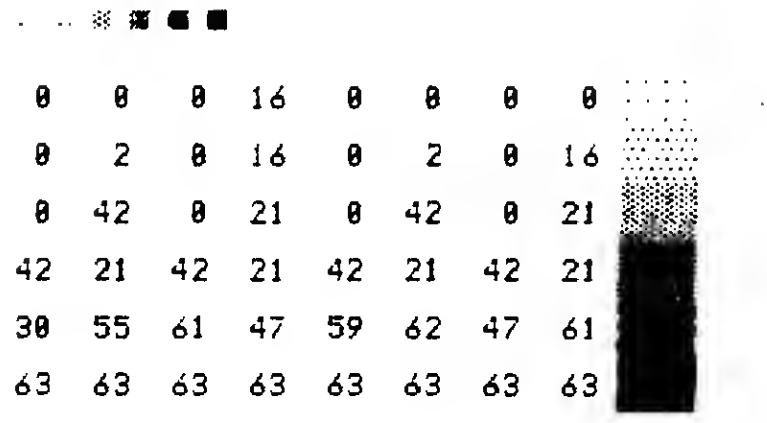

Fig. 2. Sample printout from Listing 1a

programs. They center around two main issues: quality of the finished product versus the amount of time we are willing to spend in the digitizing process. The smaller the squares used to graph the photo, the higher will be the quality of the printout, but there are a couple of things to remember here. First, smaller blocks mean you will have a smaller matrix (fewer dots) to work with in developing the shading levels. Second, smaller blocks mean more blocks. In digitizing an 8 by 10 inch photograph using 1/24 inch squares, you would have to enter (manually) over 46,000 characters into the data statements! Even using some kind of file management to prevent an Out of Memory error, you would probably need a magnifying glass and the patience of Job to complete the project.

At the other extreme, representing an 8 by 10 photo with 1/4 inch squares would require only 1280 digital characters, and the graph would be easy to see and digitize. Unfortunately, the resolution would be so poor that many details of the photo would be missing. Another problem with such low resolution is stair-stepping—the zigzag appearance of any shading boundaries that run diagonally across the photograph.

Compromise

After experimenting with several block sizes for the graph, I settled on 1/12 inch squares. The individual squares are large enough to keep track of during the manual digitizing, and the resolution is not bad. The use of 1/12 inch blocks also allowed me to design six distinct shading levels. This is enough to show some fairly subtle changes of shading within a photo. Photo 1 represents the results of this compromise. It is a printout of an 8 by 10 photograph digitized with 1/12 inch blocks. The printout was generated from 120 data statements, with each statement containing a 96-character string (11,520 characters in all). If this seems like a lot of work, it was. But the final result was worth the effort!

Shading Levels

Both the NEC and the Epson printers are capable of generating a 1/12 inch matrix of dots. On the NEC, the matrix will be eight dots wide by six dots tall, with the printer set to the Elite print style (96 dots per inch horizontally). On the Epson, we will be using a matrix 10 dots wide by six dots tall, in the 960 graphics mode (120 dots per inch horizontally). Because the horizontal dot spacing is not the same for the two printers, the dot patterns for the six shading levels will have to be unique to each printer.

Developing shading levels is not simply a matter of putting more ink or less ink on the paper within each block. The dots must be uniformly spaced within the matrix, and the pattern used must be one that does not create a separate noticeable pattern when repeated over a large area. This gets a little tricky. Just when I thought a pattern would work for, say, light grey, it turned out that the pattern produced a distracting series of zigzagging dots when I printed several in a row. Even a pattern that caused no problem there might look like a group of small circles when printed one over the other.

Experimentation

Program Listing 1a (for the NEC printer) and Program Listing 1b (for the MX-80) were written to speed up the process of developing and testing dot patterns for various shading levels. Figure 1 shows some sample dot patterns for the 8 by 6 matrix on the NEC printer. The first pattern (1/48) uses only one of the 48 possible dots in the matrix, producing a very light shading. The last pattern (48/48 shading) prints all 48 dots of the matrix, for the darkest shading possible without using a smaller horizontal dot spacing mode. The remaining patterns produce intermediate levels of shading on this printer. The dot patterns for the MX-80 are not shown, but you can draw them yourself from the data statements in Listing 1b. Remember, the top pin of the MX-80 print head is treated as if it were bit 7 of an eight-bit binary number. This is the reverse of the NEC printer, which treats the top pin as bit 0.

In Fig. 1, the decimal values that generate each pattern are shown above the columns of dots. You can experiment with other patterns by changing the data statements in Listing 1, or by adding your own.

When you run the program it will print the individual matrices, and then combine several rows and columns of the patterns, as in Fig. 2. This gives you a chance to check for unwanted patterns that may appear when a matrix is repeated. On the printout, the decimal values for each pattern are printed in a horizontal row to the left of the dots. As an example, the decimal values 0,42,0,21,0,42,0,21 will generate the third matrix from the left at the top of the figure. Of course, these are the same values that were in the data statement, but it's good to have a hard copy that relates the

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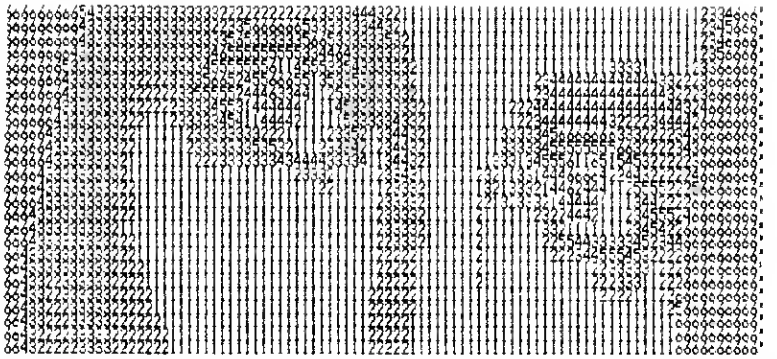

Fig. 3. LLIST data lines

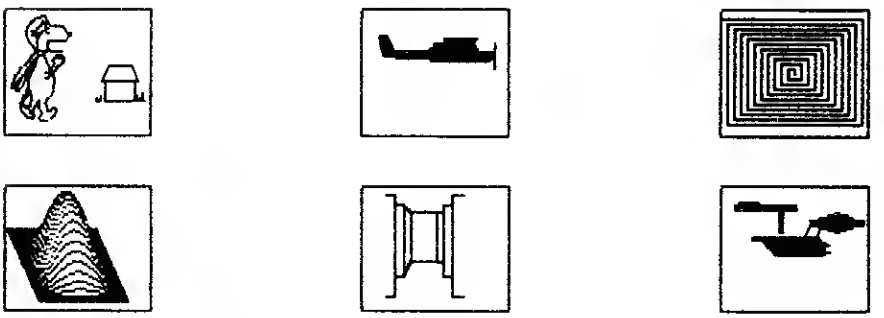

Fig. 4. Sample mini-screen prints

```
10 'SHADES a     *******  FOR NEC 8023 PRINTER  *******
20 'AIDS DEVELOPMENT OF SHADING PATTERNS FOR AN 8 x 6 MATRIX
30 '
40 '======================  INITIALIZE  ========================
50 CLEAR 1000: DEFINT A-Z: PR=14312     'PRINTER'S ADDRESS
60 LPRINT CHR$(27)+"T12"     'SET 12/144 (6/72) LINE SPACING
70 LPRINTCHR$(27)+"E"        'SELECT "ELITE" STYLE (96 DOTS/IN)
80 '
90 '===========  READ MATRICES TIL OUT OF DATA  ===============
100 ON ERROR GOTO 140          'ANTICIPATING "OUT OF DATA" ERROR
110 SH=1                       'START WITH SHADING COUNTER AT 1
120 FOR B=1 TO 8: READ SH(SH,B): NEXT B
130 SH=SH+1: GOTO 120
140 RESUME 240                 'ALL DATA HAS BEEN READ
150 '==========  EXPERIMENTAL DATA FOR 8 x 6 MATRIX  ==========
160 DATA 0,0,0,16.0,0,0,0:            '1 OUT OF 48 DOTS
170 DATA 0,2,0,16,0,2,0,16:           '4 OUT OF 48 dOTS
180 DATA 0,42,0,21,0,42,0,21:        '12 OUT OF 48 DOTS
190 DATA 42,21.42,21,42,21,42,21:    '24 OUT OF 48 DOTS
200 DATA 30,55,61,47,59,62,47,61:    '42 OUT OF 48 DOTS
210 DATA 63,63,63,63,63,63,63,63:    '48 OUT OF 48 OOTS
220 '
230 '===============  INDIVIDUAL BLOCK PRINTOUT  ===============
240 N=SH-1: ON ERROR GOTO 0          'NO MORE ERRORS EXPECTED
250 FOR SH=1 TO N
260   LPRINT" ";                     'SEPARATE THE MATRICES
270   LPRINT CHR$(27)+"S0008";       '8 GRAPHICS BYTES TO FOLLOW
280   GOSUB 440                      'SEND THE CURRENT MATRIX
290 NEXT SH: LPRINT STRING$(2,10)
300 '=============  FULL PRINTOUT FOR COMPARISONS  =============
310 INPUT"PRESS <ENTER> FOR FULL PRINTOUT... ";A$
320 FOR SH=1 TO N
330 FOR LN=1 TO 3
340 IF LN <> 2 THEN LPRINTSTRING$(32,32);: GOTO 370
350 LPRINTUSING"### ";SH(SH,1),SH(SH,2),SH(SH,3),SH(SH,4);
360 LPRINTUSING"### ";SH(SH,5),SH(SH,6),SH(SH,7),SH(SH,8);
370 LPRINT CHR$(27)+"S0032";       '32 GRAPHICS BYTES TO FOLLOW
380 FOR Q=1 TO 4: GOSUB 440: NEXT Q
390 LPRINT:NEXT LN
400 NEXT SH
410 LPRINT CHR$(27);"A"            'RESTORE NORMAL LINE SPACING
420 LPRINT STRING$(8,10): END
430 '=========  SUBROUTINE TO SEND A MATRIX TO PRINTER  =========
440 FOR B=1 TO 8
450 IF PEEK(PR) <> 63 THEN 450 ELSE POKE PR,SH(SH,B)
460 NEXT B: RETURN
```

Program Listing 1a

decimal data to its visual pattern.

Even if you are not interested in trying out patterns of your own, I would recommend a little experimentation with different values so you will have a better idea of how this works.

Selecting a Subject

Now that six levels of shading are available on the printer, we can proceed with the project. The first step is to select an appropriate photograph. This should not be done casually, because you are going to spend several hours digitizing, and a poor choice can make the job more difficult. Here are some things to consider:

Avoid color pictures. You will be busy enough determining which levels of grey to use, without the added distraction of differentiating light blue and medium-dark yellow.

"Use a photo that has a minimum of fine detail."

Use a photo that has a minimum of fine detail. A landscape scene where each blade of grass is visible may be pretty, but it might be impossible to show such detail in a 1/12 inch block. I encountered this when trying to digitize the subject's hair in my selected photo. The detail in that area was too fine to represent with 1/12 inch squares, so I simply used all dark blocks.

Avoid a photo with lots of subtle changes in shading. If one shade gradually changes to another over a large area of the photo, you will have to show this as a sharper boundary on your printout. An example of this can be seen in Photo 1 where there is a shadow on the subject's right cheek. This particular problem could be solved by developing more shading levels to choose from. In this case, I felt that the benefit would be small compared to the extra work.

A closeup portrait such as the one shown makes a very good subject. Although the eyes are fairly high in detail, they will be large enough on a closeup to be captured in digital form.

Most Important Step

After you have decided on a suitable subject, drop by the local print shop and have several photocopies made. You will be making lots of marks on a working copy, and you will need the original for comparison during the touch-up process.

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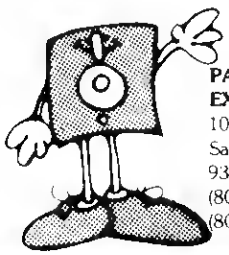

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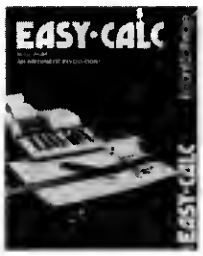

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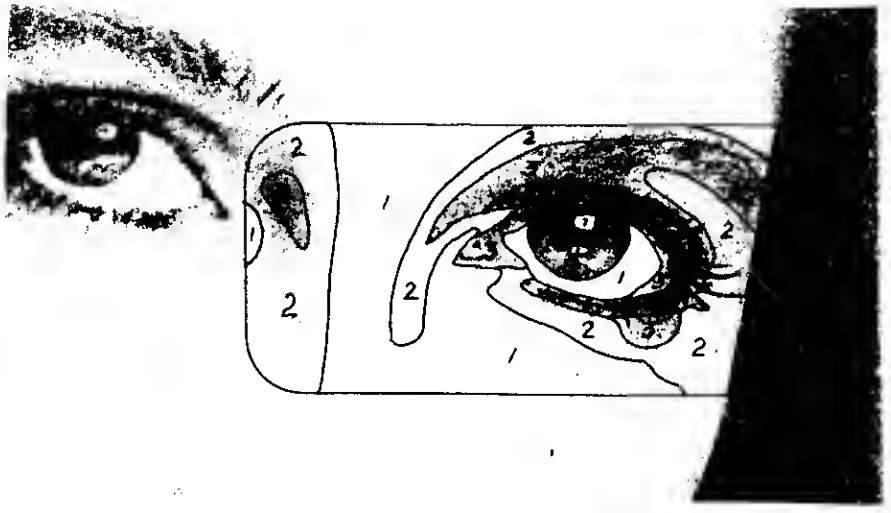

Fig. 5. Section of photo with shading levels marked

mine where your six shading levels would most closely match the shadings in the photograph. Circle these areas as in the rectangular section of Fig. 5 (you should do it for the entire photograph), and write in each area the shade that will be assigned to it. Start with all the areas that will get a shading level of six, or black. Then mark all the areas that will have the lightest shading. This will give you some perspective for assigning appropriate values to the intermediate areas.

This marking is the single most important phase of the digitizing process, so take your

```
10 'SHADES b         *******  FOR MX-80 PRINTER  *******
20 'AIDS DEVELOPMENT OF SHADING PATTERNS FOR AN 10 x 6 MATRIX
30 '
40 '=====================  INITIALIZE  ========================
50 CLEAR 1000:
DEFINT A-Z: PR=14312    'PRINTER'S ADDRESS
60 LPRINT CHR$(27)+"A"+CHR$(6)          'SET 6/72 LINE SPACING
70 '
80 '===========  READ MATRICES TIL OUT OF DATA  ===============
90 ON ERROR GOTO 130          'ANTICIPATING "OUT OF DATA" ERROR
100 SH=1                       'START WITH SHADE COUNTER AT 1
110 FOR B=1 TO 10: READ SH(SH,B): NEXT B
120 SH=SH+1: GOTO 110
130 RESUME 220                 'ALL DATA HAS BEEN READ
140 '=========  EXPERIMENTAL DATA FOR 10 x 6 MATRIX  ==========
150 DATA 0,0,8,0,0,0,0,2,0,0:                '2 OUT OF 60 DOTS
160 DATA 0,16,0,4,0,1,0,16,0,4:              '5 OUT OF 60 DOTS
170 DATA 4,17,4,17,4,17,4,17,4,17:          '15 OUT OF 60 DOTS
180 DATA 42,21,42,21,42,21,42,21,42,21:     '30 OUT OF 60 DOTS
190 DATA 63,45,63,54,63,27,63,45,63,54:     '50 OUT OF 60 DOTS
200 DATA 63,63,63,63,63,63,63,63,63,63:     '60 OUT OF 60 DOTS
210 '==============  INDIVIDUAL BLOCK PRINTOUT  ===============
220 N=SH-1: ON ERROR GOTO 0          'NO MORE ERRORS EXPECTED
230 FOR SH=1 TO N
240   LPRINT" ";                     'SEPARATE THE MATRICES
250   LPRINT CHR$(27)+"L";           '960 GRAPHICS MODE
260   POKE PR,10: LPRINT CHR$(255);    'SEND BYTE COUNT OF 10
270   GOSUB 450                      'SEND THE CURRENT MATRIX
280 NEXT SH: LPRINT STRING$(2,10)
290 '============  FULL PRINTOUT FOR COMPARISONS  =============
300 INPUT"PRESS <ENTER> FOR FULL PRINTOUT... ";A$
310 FOR SH=1 TO N
320 FOR LN=1 TO 3
330 IF LN <> 2 THEN LPRINTSTRING$(40,32);: GOTO 370
340 LPRINTUSING"### ";SH(SH,1),SH(SH,2),SH(SH,3),SH(SH,4);
350 LPRINTUSING"### ";SH(SH,5),SH(SH,6),SH(SH,7),SH(SH,8);
360 LPRINTUSING"### ";SH(SH,9),SH(SH,10);
370 LPRINT CHR$(27)+"L";               '960 GRAPHICS MODE
380 LPRINT CHR$(40)+CHR$(255);         'SEND BYTE COUNT OF 40
390 FOR Q=1 TO 4: GOSUB 450: NEXT Q
400 LPRINT:NEXT LN
410 NEXT SH
420 LPRINT CHR$(27)+CHR$(64)           'RESET PRINTER
430 LPRINT STRING$(8,10): END
440 '=========  SUBROUTINE TO SEND A MATRIX TO PRINTER =========
450 FOR B=1 TO 10
460 IF PEEK(PR) <> 63 THEN 460 ELSE POKE PR,SH(SH,B)
470 NEXT B: RETURN
```

Program Listing 1b

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- **MMF GIVES YOU A SYSTEM THAT CAN GROW WITH YOUR NEEDS,** from floppy disk systems to state of the art hard disk systems with full ECC and the industry's only SASI Multiplexer with our SASI-NET**.
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time and don't leave any areas—however small—unmarked. If you are having difficulty determining which level to assign to an area, the time to decide is now. Waiting until you are entering digits into data strings is a mistake. Believe me—I've tried it both ways. A little extra care here will pay off in time and effort saved while building the data statements. The marked copy will probably bear little resemblance to the original photograph by now, but don't get discouraged; the final printout will look a whole lot better.

```
10 'GRAPHER a   *******  FOR NEC 8023 PRINTER  *******
20 'PRINTS AN 8 x 10 INCH GRAPH OF 1/12th INCH SQUARES FOR
30 'DIGITIZING A PHOTOGRAPH. TOTAL SQUARES = 11,520
40 '
50 CLEAR 200: DEFINT A-Z
60 INPUT"TO PRINT GRAPH, PRESS <ENTER> ";A$
70 LPRINT CHR$(27);"E"          'SELECT ELITE CHARS. (96 DPI)
80 LPRINT CHR$(27);"T12"        'LINE SPACING OF 12/144 INCH
90 BL$=STRING$(7,32)+CHR$(63)    'BACKWARDS "L" (6 x 8 DOTS)
100 FOR ROW=1 TO 121
110 LPRINTCHR$(27);"S0768";    'SEND BYTE COUNT OF 768 (8*96)
120 FOR BLOK=1 TO 96: LPRINT BL$;: NEXT BLOK: LPRINT
130 PRINT"PRINTING ROW:";ROW
140 NEXT ROW: END
```

Program Listing 2a

```
10 'GRAPHER b         *******  FOR MX-80 PRINTER  *******
20 'PRINTS AN 8 x 10 INCH GRAPH OF 1/12th INCH SQUARES FOR
30 'DIGITIZING A PHOTOGRAPH. TOTAL SQUARES = 11,520
40 '
50 CLEAR 200: DEFINT A-Z
60 INPUT"TO PRINT GRAPH, PRESS <ENTER> ";A$
70 LPRINT CHR$(27)+"A"+CHR$(6)      'SET 6/72 LINE SPACING
80 BL$=STRING$(9,1)+CHR$(63)    'BACKWARDS "L" (6 x 10 DOTS)
90 FOR ROW=1 TO 121
100 LPRINT CHR$(27)+"L";          '960 GRAPHICS MODE
110 LPRINTCHR$(192)+CHR$(3);    'SEND BYTE COUNT OF 960 (10*96)
120 FOR BLOK=1 TO 96: LPRINT BL$;: NEXT BLOK: LPRINT
130 PRINT"PRINTING ROW:";ROW
140 NEXT ROW: END
```

Program Listing 2b

```
10 'DIGIFOTO a   *******  FOR NEC 8023 PRINTER  *******
20   'RECONSTRUCTS A PHOTOGRAPH FROM DATA STATEMENTS
30 '  M. KELLER        ALBUQUERQUE, NM          (505) 294-4966
40 '
50 CLEAR 200: DEFINT A-Z: PR=14312  'PRINTER'S ADDRESS
60 DIM SH(6,8)          'ARRAY TO HOLD SHADING LEVELS
70 FOR SH=1 TO 6        'DEFINE SIX 8-BYTE SHADING MATRICES
80   FOR BYTE=1 TO 8: READ SH(SH,BYTE): NEXT BYTE
90 NEXT SH
100 '=================== SHADING DATA ========================
110 DATA 0,0,0,16,0,0,0,0:            '1 OUT OF 48 DOTS
120 DATA 0,2,0,16,0,2,0,16:           '4 OUT OF 48 DOTS
130 DATA 0,42,0,21,0,42,0,21:        '12 OUT OF 48 DOTS
140 DATA 42,21,42,21,42,21,42,21:    '24 OUT OF 48 DOTS
150 DATA 30,55,61,47,59,62,47,61:    '42 OUT OF 48 DOTS
160 DATA 63,63,63,63,63,63,63,63:    '48 OUT OF 48 DOTS
170 '==================  PRINT THE PHOTO  ====================
180 INPUT"TO RECONSTRUCT THE PHOTOGRAPH, PRESS <ENTER> ";A$
190 LPRINTCHR$(27);"E";       'SET 96 DOTS PER INCH HORIZONTALLY
200 LPRINTCHR$(27);"T12"      'SELECT 6-DOT LINE SPACING
210 READ TG$: NB=LEN(TG$)     'READ PHOTO'S WIDTH
220 'NEXT LINE BUILDS STRING FOR INITIALIZING GRAPHICS MODE
230 GR$=CHR$(27)+"S"+STRING$(5-LEN(STR$(NB*8)),"0")+RIGHT$(STR$(
NB*8),LEN(STR$(NB*8))-1)
240 LN=LN+1: PRINT"PROCESSING LINE:";LN
250 LPRINT GR$;                'INITIALIZE GRAPHICS
260   FOR BLK=1 TO NB: SH=VAL(MID$(TG$,BLK,1))
270     FOR BYTE=1 TO 8
280      IF PEEK(PR) <> 63 THEN 280 ELSE POKE PR,SH(SH,BYTE)
290     NEXT BYTE
300   NEXT BLK: LPRINT
310 READ TG$: IF TG$ <> "DONE" THEN 240
320 LPRINT CHR$(27);"A";           'RESTORE NORMAL LINE SPACING
330 LPRINT CHR$(27);"N"            'RESTORE NORMAL CHARACTERS
340 END
350 'DATA LINES CAN BE ADDED HERE OR MERGED FROM ANOTHER FILE.
5000 DATA"DONE"
```

Program Listing 3a

Graphing

The next step involves printing the graph over the copy you just marked. A fresh ribbon should be used for this, especially if your photo has large areas of dark shading. Program Listing 2 (a or b) prints the graph. Run it with the marked photocopy in the printer (if your MX-80 does not have friction-feed, you can tape the copy to some fanfold and use the fanfold as a carrier). It is important to position the copy correctly in the printer before generating the graph, as you will only have one shot at this. Try printing the graph first on a plain sheet of paper to determine the alignment you will need. When the graph has been printed on the marked copy, you will have something like the copy in Fig. 6.

"There will be cases where. . . you will have to wing it."

After printing the graph, it's a good idea to number every fifth block across the top and down the left side of the graph, as in Fig. 6. This will help you keep track of your location on the graph as you convert the shading levels into data statements.

Almost There

The final step takes longest, but should go pretty smoothly if you prepared the copy well. Program Listing 3 (a or b) generates the final printout, and lacks only the data strings which define your photo. Key in the version for your printer and save it so it can be used as a shell for any future photos you might want to digitize.

Start the data statements with line 1001, using a line numbering increment of one. With the fingers of one hand on the number keys and the other hand keeping track of the current block on the graph, build each data string. Your markings will make it easy to see which shading level applies to each block, so you will not be slowed down by having to make the shading decisions as you go along. Each data string corresponds to a row of the graph, so start a new line in the program when you reach the end of a row.

There will certainly be cases where a block is half one shade and half another. In those cases, you will have to wing it. A glance at the original photograph will help here, but don't get sidetracked. Deviating from the shadings you decided on earlier

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```
*********************************
*       DATA BASE BLUES         *
*********************************
*1.DOES YOUR DATA BASE MANAGEMENT PROGRAM *
*  MEET ALL OF YOUR REQUIREMENTS?         *
*2.DO YOU NEED TO ADD ADITIONAL FILES OR  *
*  FIELDS TO THE DATA BASE?               *
*3.CAN YOU MODIFY YOUR DATA BASE ANY TIME?*
*4.ARE YOU LIMITED TO THE NUMBER OF SCREEN*
*  OR PRINTER FORMATS ALLOWED?            *
*5.DO YOU HAVE TO USE MORE THAN ONE DATA  *
*  BASE BECAUSE THE ONE YOU ARE USING WILL*
*  NOT HANDLE DATA BASES WITHIN DATA BASES?*
*6.DOES YOUR DATA BASE HAVE ALL THE SPEED *
*  OF MACHINE LANGUAGE IN BASIC FORMAT?   *
*7.ARE YOUR FIELDS LIMITED IN LENGTH AND  *
*  NUMBER? CAN YOU ADD MORE LATER?        *
*8.CAN YOU CLAIM THAT YOU WROTE IT WITH   *
*  LITTLE OR NO PROGRAMING KNOWLEDGE?     *
*IF  YOU ANSWERED NO  TO  ANY OF  THE ABOVE*
*THEN YOU NEED:                          *
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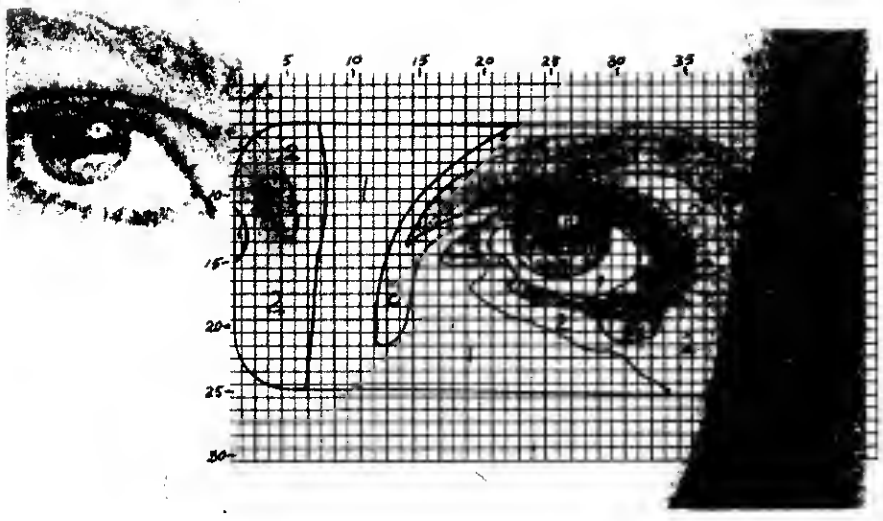

Fig. 6. Graphed copy ready for digitizing

can start a chain reaction of bad choices in the rest of that line.

Take Five

Building the data statements is a tedious process, and I recommend that you take plenty of breaks. It's also a good idea to generate a printout every so often to see how things are going, but don't expect too much. The image will undoubtedly need touching up in a few places. Besides, a portion of the picture won't look as good by itself as it will in the full printout.

If you reach the end of a row, and the data line you just typed in does not have the same number of characters as the preceding lines, you are better off to completely redo the line. It is almost impossible to backtrack and find the place where you goofed.

If you plan to include a printed border around your final printout, as I did, use a six as the first and last character of each data statement. Also, the first and last data lines should consist of all sixes.

Touching Up

Try not to make any alterations until the entire photo is digitized. Something that looks wrong when partially completed may fall into place after the next few lines are added. In touching up the data for Photo 1, I used the following method: When the image was complete, I generated a printout on a sheet of tracing paper. Placing this over the original photo showed the blocks that needed changing. Some blocks were too dark on the printout, and some were too light. Those that were too light were the easiest to spot. By listing the data lines in the affected area (as in Fig. 3), I was able to find and correct those characters which were wrong. The printer was set to a small line spacing before listing, so that the erroneous characters would be easier to identify.

Feel free to exercise a little artistic freedom in the touch-up process. If your original photo contains a blemish, or there is an area you would like to enhance, go right ahead. After all, it's your paintbrush.

When you are satisfied with the printout, it is ready to be printed on a good sheet of bond paper. A full printout of an 8 by 10 photograph will take about 30 minutes on the NEC printer, and about 50 minutes on the MX-80. Before wrapping everything up, make sure you save the data statements as you would save a program. They can be merged with the shell program any time you want a printout.

Instant Replay

Here is a summary of the steps used in digitizing the photograph:

- Select an appropriate subject
- Have photocopies made
- Outline and mark the shaded areas
- Superimpose the graph
- Build the data statements
- Touch up the data as necessary
- Generate a final printout
- Save the data lines on disk

Manipulation

Images are often converted into a digital form for scientific and other applications. This is usually to make it possible to manipulate the image in some manner. There are many ways in which an image might be manipulated. For example, if you want a negative of your digitized photograph, change line 70 of Listing 3 to read:

```
FOR SH=6 TO 1 STEP -1:
```

This sets up the shading levels in reverse order, so a data character which calls for shading 1 will show up on the printout as shading 6, and vice versa.

Another type of manipulation would be to eliminate some intermediate shading levels in the printout. This produces an image that is more highly contrasted, showing contours that may not be noticeable with subtle shading boundaries. One way to do this is to add the following line immediately after line 260 (line 300 of the MX-80 version):

```
IF SH/2 = INT(SH/2) THEN SH=SH-1
```

This eliminates any even-numbered shadings, printing them instead as the next

```
10 'DIGIFOTO b        *******  FOR MX-80 PRINTER  *******
20 'RECONSTRUCTS A PHOTOGRAPH FROM DATA STATEMENTS
30 '  M. KELLER          ALBUQUERQUE, NM          (505) 294-4966
40 '
50 CLEAR 200: DEFINT A-Z: PR=14312  'PRINTER'S ADDRESS
60 DIM SH(6,10)          'ARRAY TO HOLD SHADING LEVELS
70 FOR SH=1 TO 6         'DEFINE SIX 10-BYTE SHADING MATRICES
80   FOR BYTE=1 TO 10: READ SH(SH,BYTE): NEXT BYTE
90 NEXT SH
100 '=================== SHADING DATA ==========================
110 DATA 0,0,8,0,0,0,0,2,0,0:              '2 OUT OF 60 DOTS
120 DATA 0,16,0,4,0,1,0,16,0,4:            '5 OUT OF 60 DOTS
130 DATA 4,17,4,17,4,17,4,17,4,17:         '15 OUT OF 60 DOTS
140 DATA 42,21,42,21,42,21,42,21,42,21:    '30 OUT OF 60 DOTS
150 DATA 63,45,63,54,63,27,63,45,63,54:    '50 OUT OF 60 DOTS
160 DATA 63,63,63,63,63,63,63,63,63,63:    '60 OUT OF 60 DOTS
170 '==================  PRINT THE PHOTO  ====================
180 INPUT"TO RECONSTRUCT THE PHOTOGRAPH, PRESS <ENTER> ";A$
190 LPRINTCHR$(27)+"A"+CHR$(6)      'SELECT 6-DOT LINE SPACING
200 READ TG$: NB=LEN(TG$)           'READ PHOTO'S WIDTH
210 'NEXT FOUR LINES SET BYTE COUNT CODES FOR MX-80
220 IF NB*10 <= 255 THEN BC=NB*10: BC$=CHR$(255): GOTO 270
230 IF NB*10 > 767 THEN BC=NB*10-768: BC$=CHR$(3): GOTO 270
240 IF NB*10 > 511 THEN BC=NB*10-512: BC$=CHR$(2): GOTO 270
250 BC=NB*10-256: BC$=CHR$(1)
260 '
270 LN=LN+1: PRINT"PROCESSING LINE:";LN
280 LPRINT CHR$(27)+"L";                 '960 GRAPHICS MODE
290 POKE PR,BC: LPRINT BC$;              'SEND BYTE COUNT
300   FOR BLK=1 TO NB: SH=VAL(MID$(TG$,BLK,1))
310     FOR BYTE=1 TO 10
320       IF PEEK(PR) <> 63 THEN 320 ELSE POKE PR,SH(SH,BYTE)
330     NEXT BYTE
340   NEXT BLK: LPRINT
350 READ TG$: IF TG$ <> "DONE" THEN 270
360 LPRINT CHR$(27)+CHR$(64)             'RESET PRINTER
370 END
380 'DATA LINES CAN BE ADDED HERE OR MERGED FROM ANOTHER FILE.
5000 DATA"DONE"
```

Program Listing 3b

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lower level. Although probably not very useful with the small number of shadings we are printing, this effect is invaluable in other applications. It was used, for example, to bring out details in the digital photographs taken by the Voyager spacecraft. By comparison, those pictures consisted of 64,000 blocks, and each block could have one of 256 shading levels.

You might want to try generating a mirror image of the photo. Changes in the shading data might also produce some interesting effects. Once the photograph information is in a digital form, there is almost no limit to the ways in which it can be processed.

Miniature TRS-80

As promised, I have included as a final example of digitizing, a program that prints a miniature (less than 1-inch) copy of the TRS-80 screen. This is done with Program Listing 4 (a or b). It reads the screen pixels (the blocks which can be set or reset), and prints each lighted pixel as a dot on the paper. Since these pixels are arranged on the screen in a 48 by 128 matrix, the dots in the printout are arranged in the same way. At this tiny size it's not possible to duplicate any alphanumeric characters on the screen. You may have a few programs, however, that display some pretty fancy figures using the TRS-80's graphic blocks. These will be reconstructed by the program, surrounded by a rectangular border as in Fig. 4. If you are using an MX-80 printer, you will notice some distortion in the aspect ratio (ratio of height to width).

The program takes a little over three minutes to generate a screen print. A negative image can be produced by changing line 5160 to this:

```
A(COL,ROW) = POINT(COL,ROW + REF) + 1
```

Each sample printout shown in Fig. 4 was generated by merging the routine with a main program. You might recognize a few of these designs, since some are from popular programs. At some convenient place in the main program after the screen display was complete, I inserted a GOTO statement to cause a jump to the mini-screen routine.

Mini-screen could be used as a subroutine for multiple screen prints during a single program run, but the Clear and DEFINT statements will have to be removed from line 5050, and the A array will have to be dimensioned in the main program. By setting horizontal tabs from within the program, you can print several images side-by-side. This effect can also be achieved on the NEC printer by changing the left margin.

For those who are curious about how the conversion is done, the key line of the program is line 5070. It is a defined function which converts a vertical pattern of eight screen pixels into a single decimal value. This value is sent to the printer in line 5220 (line 5230 in the MX-80 version), reproducing the vertical pattern with dots. The process is repeated until the end of a screen line is reached. A carriage return is then executed and the next column of eight pixels is done the same way.

Hidden Artists

I hope these articles have given you some food for thought. The projects were fun and challenging for me, and like most undertakings of this type, provided a valuable learning experience. As is always the case with programming, the methods outlined here represent only one approach. With a little imagination, you can unlock even more of the artist built into your smart printer, and maybe a little of the artist in you. ■

Mike Keller enjoys using the computer as a tool in the creative process.

```
5000 'MINI-SCREEN a       *******  FOR NEC 8023 PRINTER  *******
5010 'DOES MINIATURE TRS-80 SCREEN-PRINT (GRAPHICS ONLY)
5020 '  M. KELLER       ALBUQUERQUE, NM        (505) 294-4966
5030 '
5040 '==================== INITIALIZE ========================
5050 CLEAR 1000: DEFINT A-Z: PR=14312: DIM A(128,7)
5060 'FUNCTION TO CONVERT 8 VERTICAL PIXELS TO A DECIMAL VALUE
5070 DEF FN F1(X)=A(COL,0)+A(COL,1)*2+A(COL,2)*4+A(COL,3)*8+A(CO
L,4)*16+A(COL,5)*32+A(COL,6)*64+A(COL,7)*128
5080 '===============  PRINT SCREEN GRAPHICS  ================
5090 LPRINT CHR$(27);"P";                 'PROPORTIONAL SPACING
5100 LPRINT CHR$(27);"T16"                '2/3 LINE SPACING
5110 LPRINTCHR$(27)+"S0132";              'GRAPHICS, 132 BYTES
5120 LPRINTCHR$(128)+STRING$(130,64)+CHR$(192)   'TOP BORDER
5130 FOR REF=0 TO 40 STEP 8               '6 PASSES WILL BE NEEDED
5140    FOR COL=0 TO 127
5150      FOR ROW=0 TO 7
5160         A(COL,ROW)= -(POINT(COL,ROW+REF))
5170      NEXT ROW
5180    NEXT COL
5190    LPRINT CHR$(27)+"S0132";       'GRAPHICS MODE, 132 BYTES
5200    LPRINTCHR$(255);:POKE PR,0     'SEND LEFT BORDER
5210    FOR COL=0 TO 127
5220     IF PEEK(PR) <> 63 THEN 5220 ELSE POKE PR,FN F1(X)
5230    NEXT COL
5240    POKE PR,0:LPRINTCHR$(255)      'SEND RIGHT BORDER
5250 NEXT REF
5260 LPRINTCHR$(27)+"S0132";           'GRAPHICS MODE, 132 BYTES
5270 LPRINTCHR$(3)+STRING$(130,2)+CHR$(3)        'BOTTOM BORDER
5280 LPRINT CHR$(27);"A";              'SET NORMAL LINE SPACING
5290 LPRINT CHR$(27);"N";              'SELECT PICA PRINT STYLE
5300 END
```

Program Listing 4a

```
5000 'MINI-SCREEN b       *******  FOR MX-80 PRINTER  *******
5010 'DOES MINIATURE TRS-80 SCREEN-PRINT (GRAPHICS ONLY)
5020 '  M. KELLER       ALBUQUERQUE, NM        (505) 294-4966
5030 '
5040 '==================== INITIALIZE ========================
5050 CLEAR 1000: DEFINT A-Z: PR=14312: DIM A(128,7)
5060 'FUNCTION TO CONVERT 8 VERTICAL PIXELS TO A DECIMAL VALUE
5070 DEF FN F1(X)=A(COL,7)+A(COL,6)*2+A(COL,5)*4+A(COL,4)*8+A(CO
L,3)*16+A(COL,2)*32+A(COL,1)*64+A(COL,0)*128
5080 '===============  PRINT SCREEN GRAPHICS  ================
5090 LPRINT CHR$(27);"A"+CHR$(8)               '8/72 LINE SPACING
5100 LPRINTCHR$(27)+"L";                       '960 GRAPHICS MODE
5110 LPRINTCHR$(132)+CHR$(255);               'SEND THE BYTE COUNT
5120 LPRINTCHR$(3)+STRING$(130,2)+CHR$(3)    'TOP BORDER
5130 FOR REF=0 TO 40 STEP 8                   '6 PASSES WILL BE NEEDED
5140    FOR COL=0 TO 127
5150      FOR ROW=0 TO 7
5160        A(COL,ROW)= -(POINT(COL,ROW+REF))
5170      NEXT ROW
5180    NEXT COL
5190    LPRINT CHR$(27)+"L";                   '960 GRAPHICS MODE
5200    LPRINTCHR$(132)+CHR$(255);            'SEND THE BYTE COUNT
5210    LPRINTCHR$(255);:POKE PR,0             'SEND LEFT BORDER
5220    FOR COL=0 TO 127
5230     IF PEEK(PR) <> 63 THEN 5230 ELSE POKE PR,FN F1(X)
5240    NEXT COL
5250    POKE PR,0:LPRINTCHR$(255)              'SEND RIGHT BORDER
5260 NEXT REF
5270 LPRINTCHR$(27)+"L";                       '960 GRAPHICS MODE
5280 LPRINT CHR$(132)+CHR$(255);               'SEND BYTE COUNT
5290 LPRINTCHR$(128)+STRING$(130,64)+CHR$(192)    'BOTTOM BORDER
5300 LPRINT CHR$(27)+CHR$(64)                  'RESET PRINTER
```

Program Listing 4b

```
**********************
*    DATA BASE  BLUES  *
**********************
*1.DOES YOUR DATA BASE MANAGEMENT PROGRAM  *
*  MEET ALL OF YOUR REQUIREMENTS?          *
*2.DO YOU NEED TO ADD ADITIONAL FILES OR   *
*  FIELDS TO THE DATA BASE?                *
*3.CAN YOU MODIFY YOUR DATA BABE ANY TIME? *
*4.ARE YOU LIMITED TO THE NUMBER OF SCREEN *
*  OR PRINTER FORMATS ALLOWED?             *
*5.DO YOU HAVE TO USE MORE THAN ONE DATA   *
*  BASE BECAUSE THE ONE YOU ARE USING WILL *
*  NOT HANDLE DATA BASES WITHIN DATA BASES?*
*6.DOES YOUR DATA BASE HAVE ALL THE SPEED  *
*  OF MACHINE LANGUAGE IN BASIC FORMAT?    *
*7.ARE YOUR FIELDS LIMITED IN LENGTH AND   *
*  NUMBER? CAN YOU ADD MORE LATER?         *
*8.CAN YOU CLAIM THAT YOU WROTE IT WITH    *
*  LITTLE OR NO PROGRAMING KNOWLEDGE?      *
*IF  YOU ANSWERED NO  TO  ANY OF  THE  ABOVE*
*THEN YOU NEED:                           *
*          $ DBM Sub $                     *
*DBM  Sub WILL GIVE YOU ALL OF THE ABOVE AND*
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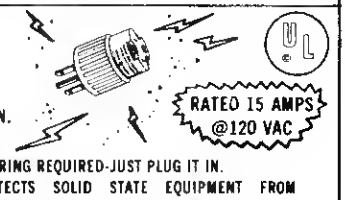

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Bustout

by Terry Hague

At first glance, Bustout seems like a simple game. You get three bars of green lights, worth 50, 25, and 10 points. The object is to knock out as many lights as possible.

But Bustout is difficult to master. You have only three balls, and the paddle is difficult to control. My high score at the expert level is only 2,400.

This Color Computer game gives you three chances to knock out as many lights as possible.

Bustout is written for the Color Computer. You need joysticks and at least 4K of memory. You also must be able to POKE 65495,0 to play at the expert level. If your computer locks up when you POKE, you can still play, but you'll have to delete lines 10–40. ■

Program Listing

```
10 CLS:PRINT"ENTER (1) BEGINNER":PRINT"       (2) EXPERT"
20 A$=INKEY$:IF A$="" THEN GOTO20
30 IF A$="1"GOTO50
40 POKE 65495,0
50 CLS(0)
60 T=4:A=0
70 FORX=10 TO 53:SET(X,5,1):SET(X,7,1):SET(X,9,1):NEXTX
80 N=JOYSTK(0):IF N<10 THEN N=10
90 IF N>50 THEN N=50
100 IF N=M GOTO 140
110 RESET(M,29):RESET(M+1,29):RESET(M+2,29)
120 M=N
130 SET(M,29,1):SET(M+1,29,1):SET(M+2,29,1)
140 IF A=0 GOTO200
150 IF A<=10 THEN B=B*-1:A=10:SOUND 200,1
160 IF A>=53 THEN B=B*-1:A=53:SOUND 200,1
170 IF C<=5 THEN D=D*-1
180 IF C=5 THEN SOUND 150,1
190 IF A>0 GOTO 220
200 G=PEEK(65280):IF G=126 THEN GOSUB310
210 IF G=254 THEN GOSUB310
220 RESET(A,C)
230 IF A=0 GOTO80
240 A=A+B:C=C+D
250 IF A<10 THEN A=10
260 IF A>53 THEN A=53
270 IF POINT(A,C)=1 THEN GOSUB 470
280 SET(A,C,1)
290 IF C=28 THEN GOSUB340
300 GOTO80
310 A=11:B=1:C=RND(9):C=C+9:D=1
320 PRINT@1,T-2:PRINT@25,S
330 RETURN
340 IF A=M GOTO 400
350 IF A=M+1 GOTO 400
```

Listing continues

A	=	Horizontal location of ball
B	=	Horizontal speed of ball
C	=	Vertical location of ball
D	=	Vertical speed of ball
M	=	Joystick location
F	=	Your score
T	=	Number of balls
W	=	High score

Table 1. List of Variables.

The Key Box

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4K RAM
Color Basic
Joysticks

Continues on p. 299

Terry Hague lives at Pole 113 Rocky Hill Road, North Scituate, RI 02857.

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If you had to mount Library disks every time you needed some files, Hexman would be no better than the old way of doing things. But here comes the clever part. Hexman knows which files are in the Filestore, so it only loads files if they are not currently available in the Filestore. It counts how frequently you use each file, and ensures that the files in the Filestore are the ones that are used most frequently. If the Filestore disks are getting too full, Hexman removes the least frequently used files. Because the most active files are kept in the Filestore, the chances are that any file you need will be ready and waiting. Only when you request a rarely used file does Hexman need to move it in from the Library. Thus as Hexman becomes familiar with your pattern of file usage, transfers from the Library drop to a minimum.

Each morning, when you first use Hexman, it scans your Filestore, notes any changes and takes action. Any new files are automatically cataloged. New and updated files are backed up to the Library. Hexman makes this easy to do by sorting the tiles into Library disk sequence, then prompting you to insert the appropriate Library disks one after the other. This Filestore scan and backup process ensures that your disk Library files match the active files in your Filestore. Thus you can safely treat the few Filestore disks in your drives as it they contained your whole disk Library.

Besides the basic Storage Management Module described above, additional modules are available for those that need the extra power. The Security module creates two additional copies of any vital files, and allows off-site storage of one of those copies. The KeySearch module allows the cataloging and retrieval of files by keywords (also called headings or categories). This module allows fast retrieval of files even when you can't remember their names. Other extension modules for the Hexman system are planned.

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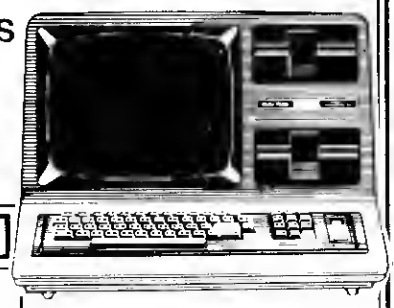

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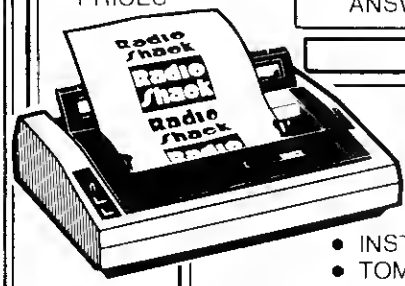

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Listing continued

```
360 IF A=M+2 GOTO 400
370 T=T-1:IF T=1 THEN GOSUB620
380 RESET(A,C)
390 A=0:RETURN
400 IF A=M THEN B=B-1
410 SOUND 100,1
420 IF A=M+2 THEN B=B+1
430 IF B>2 THEN B=2
440 IF B<-2 THEN B=-2
450 D=D*-1
460 RETURN
470 RESET(A,C):RESET(A+1,C)
480 IF C=5 THEN SOUND 25,1
490 IF C=5 THEN S=S+50
500 IF C=7 THEN SOUND 50,1
510 IF C=7 THEN S=S+25
520 IF C=9 THEN SOUND 75,1
530 IF C=9 THEN S=S+10
540 PRINT@25,S
550 D=D*-1:C=C+D
560 FOR X=10 TO 53
570 Y=POINT(X,5):IF Y=1 THEN RETURN
580 Y=POINT(X,7):IF Y=1 THEN RETURN
590 Y=POINT(X,9):IF Y=1 THEN RETURN
600 NEXT
610 GOTO 50
620 CLS
630 PRINT"YOUR SCORE WAS";S
640 IF S>W THEN W=S
650 S=0
660 PRINT"THE HIGH SCORE WAS";W
670 PRINT"DO YOU WISH TO PLAY AGAIN (Y/N) ?"
680 A$=INKEY$:IF A$="" GOTO 680
690 IF A$="N" GOTO720
700 IF A$="Y"GOTO50
710 GOTO680
720 POKE 65494,0
```


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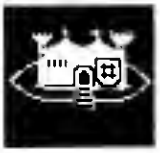

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Dennis Black, Owner

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Ordering Via Recursive Routines

by John Stover

How many different permutations (orderings) are there for N different items? The answer is easy to find. It is simply N! (N factorial, which is N* (N-1) * (N-2) * (N-3)...1). Thus the number of possible orderings for six different items is six factorial, 6*5*4*3*2*1, or 720.

But what are those orderings? If you have only a few items, it is easy to write the orderings. For example, the six possible orderings of the first three integers are 123, 213, 132, 231, 312, and 321. It isn't difficult to write the orderings for larger numbers of items, but it is tedious.

Recursive routines can calculate all possible number combinations in a small amount of code.

I needed a routine to generate all the possible orderings in a gene-sequencing program of any number of items. I decided to use a recursive routine. A recursive routine is one that calls itself. The simplest example would be: 10 GOSUB 10. Recursive routines are very powerful in certain programming applications. The Program Listing shows how these routines can make a very short program handle a complicated task.

Consider the possible ordering of the first six integers. You could start with the ordering 123456. Next, you would switch one and two to produce 213456. The next ordering would move the three over one space to the left, producing 231456. The next would switch one and two again, and so on. The general idea is to keep the six in the last position until all the possible combinations of five digits have been exhausted. Similarly, we want to keep the five in the fifth place until all possible permutations of four digits have been exhausted, and so on down to the first two digits. This is how the Program Listing works.

The number of digits to be ordered is entered in line 130. The digits are placed in numerical order for the first permutation (lines 160–180) and printed (line 200).

At line 210 the level, L, is set equal to the number of digits. Assuming the level is greater than two (the trivial case) the program transfers to the main routine at line 430. Since you want to maintain the highest-order digit in its place while switching all the others, the program immediately reduces the level by one (L = L – 1) and, if you have not yet reached the trivial case of L = 2, goes to line 440, which calls the same subroutine again. The same logic continues to apply. You want to maintain the next-

Program Listing

```
10 REM ************************************
**********
20 REM ROUTINE TO CALCULATE ALL PERMUTATIONS
OF N DIGITS
30 REM ************************************
**********
40 REM L(I)=THE PLACE IN THE ORDER OF THE DIG
IT I
50 REM O(I)=THE DIGIT IN PLACE NUMBER I
60 REM I(L)=TEMPORARY STORAGE OF THE LEVEL BE
ING CALCULATED
70 REM N=THE NUMBER OF DIGITS
80 REM L=THE LEVEL (NUMBER OF DIGITS) BEING P
ROCESSED CURRENTLY
90 REM NO=THE PERMUTATION NUMBER
100 REM ************************************
***
110 REM ROUTINE STARTS HERE
120 REM ************************************
***
130 INPUT "ENTER THE NUMBER OF DIGITS  ";N
140 DIM O(N),L(N),I(N)
150 NO=0
160 FOR I=1 TO N
170 O(I)=I:L(I)=I:I(I)=N
180 NEXT
200 GOSUB 600
210 L=N
220 IF L>2 GOSUB 430
```

Listing continues

The Key Box

Model I, II, II, or Color Computer
4K RAM
All Basics

highest digit in its place while changing all lower digits. So the level is again reduced by one and a check is made to see if the level has been reduced to two. This process of reducing the level by one and calling the same subroutine continues until you finally reach level two.

Once level two is reached the program goes to line 330, which simply switches the position of the first and second digits, prints the new order, and returns to line 430. Control then passes to line 450 where the level is increased by one and all possible permutations of the lower digits are generated (thus the statement FOR Z=1 TO L-1 in line 460). Once this has been completed, the digit corresponding to the current level is moved one column to the left (line 550) and the subroutine calls itself again (line 570) to generate all the permutations of the lesser digits.

This process continues until the digit corresponding to the current level reaches the leftmost column. Then line 590 returns to 450 where the level is increased by one and the whole process repeated. This continues until the program has worked its way back to the highest level (the total number of digits). At this point all the GOSUBs in line 440 have been completed by Returns from line 590 and the program terminates with a final Return to line 220.

The number of permutations expands rapidly as you add digits. There are 120 permutations of five digits and 3.6 million orderings of 10 digits.

Recursive routines let you write programs that generate all the permutations of any number of digits while requiring only 17 lines of code. ■

John Stover can be reached at 204 Cedar Hollow Drive, Rocky Hill, CT 06067.

Listing continued

```
230 IF L=2 THEN GOSUB 330
240 PRINT"DONE":END
300 REM ************************************
***
310 REM SWITCH ORDER OF FIRST AND SECOND ITEM
S
320 REM ************************************
***
330 X=L(1):L(1)=L(2):L(2)=X:GOSUB 630  :RETUR
N
400 REM ************************************
****
410 REM MAIN PERMUTATIONS ROUTINE
420 REM ************************************
****
430 L=L-1:IF L=2 GOSUB 330  :GOTO 450
440 GOSUB 430
450 L=L+1
460 FOR Z=1 TO L-1
470 PL=0:P1=0
480 P1=P1+1:IF P1>L-1 GOTO 550
490 PL=PL+1
500 F=0:FOR X1=L TO N
510 IF PL=L(X1) THEN F=1:X1=N
520 NEXT
530 IF F=1 GOTO 490
540 L(P1)=PL:GOTO 480
550 X=L(L-Z):L(L-Z)=L(L):L(L)=X:GOSUB 630
560 L=L-1:IF L=2 THEN GOSUB 330  :GOTO 580
570 I(L)=Z:GOSUB 430  :Z=I(L)
580 L=L+1:NEXT Z
590 RETURN
600 REM ************************************
***
610 REM PRINT OUT ORDER
620 REM ************************************
***
625 PRINT"NO.   *PERMUTATIONS*"
630 FOR I=1 TO N:O(L(I))=I:NEXT
640 NO=NO+1
650 F$="### ## ## ## ## ## ## ## ## ## ## ##
## ## ## ##"
660 PRINTUSING F$;NO;
670 FOR I=1 TO N:PRINTUSING F$;O(I);:NEXT:PRI
NT
680 RETURN
```


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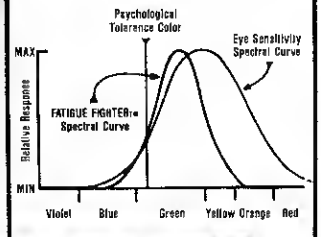

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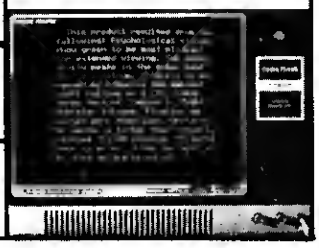

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✓ See List of Advertisers on Page 339

Robot Reader

by Charles Gillen

How can you judge the difficulty of a text and know that it's appropriate for your audience? My program, Robot-Reader, scans a 100-word sample of any text and tells you how much education is required to understand it. Robot-Reader runs on a 16K Level II Model I or III.

This short Basic program accepts text, analyzes it, and tells you its difficulty level.

Background

Even before computers were common, educators devised formulae to judge the difficulty level of a text based on the number of words per sentence, and the frequency of long words. One formula takes the average number of words per sentence plus the percentage of long words (three or more syllables) and multiplies this by a standard factor. This formula (see line 280 of the Program Listing) is fine for lower-school grades, but gives an inflated rating for more difficult texts. It accurately classifies the familiar "See Dick. See Dick run," as suited for first grade, but rates high school material as requiring many years of post-graduate study.

A different formula (line 290) used by the Department of Defense to measure and standardize written English also uses the average number of words per sentence, but stresses the average number of syllables per word. This formula is more reasonable at higher education levels, but yields a negative grade when confronted with "See Dick."

By sampling various texts, I found the two formulae seemed to agree in the area of the sixth grade. Robot-Reader analyzes a text with both formulae and uses the more appropriate formula to make a final recommendation.

The Program

Robot-Reader monitors each letter, counts syllables, and ticks off each sentence as you type in a sample text. It does this between each keystroke, so if you type faster than 15 words per minute it can't keep up. If your keyboard has a CPU clock speed-up installed, just throw the switch and zip along as usual.

I put program initialization and instructions in lines 350–510 at the bottom of the listing, so I could locate the text input section (lines 20–120) at the top in the interest of faster execution. The input section counts vowels and assumes

Program Listing

```
0 REM "ROBOT-READER"  BY CHARLES E. GILLEN  12 FEB 82
10 CLS:GOTO350 :REM *** TEXT INPUT ROUTINE FOLLOWS:
20 A=INKEY$:IFA=""THEN20ELSEPRINTA;:B=RIGHT$(B,3)+A
30 IFA="A"ORA="E"ORA="I"ORA="O"ORA="U"ORA="Y"THENS=S+1:V=V+1ELSE
V=0:GOTO50
40 IFV=2THENS=S-1:V=0
50 G=RIGHT$(B,4):IFG="DED "ORG="DED."ORG="TED "ORG="TED."THEN90
60 G=RIGHT$(B,3):IFG="LE "ORG="LE."THEN90
70 IFG="ED "ORG="ED."THENS=S-1:GOTO90
80 G=RIGHT$(B,2):IFG="E "ORG="E."THENS=S-1
90 IFA=DTHENN=N+1:IFS>2THENL=L+1
100 IFA=CTHENW=W+1:IFS>2THENL=L+1
110 IFA=CORA=DTHENT=T+S:S=0
120 IFA=EORW>=QANDA=DTHEN140ELSEA="":GOTO20
130 REM *** ANALYSIS
140 IFN=0THEN490:REM NO SENTENCES TYPED
150 CLS:PRINT:PRINT:PRINT:PRINTTAB(20)"ANALYSIS OF TEXT SAMPLE:
```

Listing continues

A-G	are defined as strings
A$	INKEY$ input of sample text
B$	Contains last four letters input
C$	CHR$(32), blank space
D$	CHR$(45), a period
E$	CHR$(13), the enter key
F$	PRINT USING formatter
Integer and single precision variables:	
L	Counts long words
N	Counts sentences
Q	Length of sample: 100 words
R1	Result of low-range formula
R2	Result of high-range formula
S	Counts syllables per word
T	Total syllables in text
V	Counts vowels
W	Counts words

Table 1. Program Variables

The Key Box

Model I/III, II/12/16
16K RAM I/III, 64K RAM II/12/16
Cassette and Disk Basic

Listing continued

```
160 PRINT:PRINTTAB(13)USINGF;N;:PRINT"SENTENCE";
170 IFN>1THENPRINT"S";:REM ADD PLURAL
180 PRINT" IN SAMPLE":W=W+1:IFT<WTHENT=W
190 PRINTTAB(13)USINGF;W;:PRINT"TOTAL NUMBER OF WORDS
200 IFW=W/NTREN220:REM IF ONLY ONE SENTENCE
210 PRINTTAB(13)USINGF;W/N;:PRINT"AVERAGE WORDS PER SENTENCE
220 IFL<1THEN250:REM SKIP NEXT IF NO LONG WORDS
230 PRINTTAB(13)USINGF;L;:PRINT"LONG WORDS ( 3 + SYLLABLES)
240 PRINTTAB(13)USINGF;100*L/W;:PRINT"PERCENT LONG WORDS
250 IFT/W<1.01THEN270:REM SKIP IF ALL WORDS = 1 SYLLABLE
260 PRINTTAB(13)USINGF;T/W;:PRINT"AVERAGE SYLLABLES PER WORD
270 PRINT:PRINT"EDUCATIONAL GRADE LEVEL --> ";
280 R1=(W/N+100*L/W)*.4:REM LOW RANGE FORMULA
290 R2=(.39*(W/N))+(11.8*(T/W))-15.59:REM HI RANGE FORMULA
300 IFR1>6.7ANDR2<R1THENPRINTUSINGF;R2:GOTO320
310 PRINTUSINGF;R1:REM LO RANGE BELOW GRADE 6.7
320 PRINT@974,"< ENTER > TO TEST ANOTHER SAMPLE";
330 IFINKEY$<>ETHEN330ELSERUN:REM LOOK FOR <ENT>
340 REM *** INITIALIZATION
350 DEFSTR A-G:DEFINT L,N,Q,S,T,V,W
360 Q=100:REM MAXIMUM WORDS IN SAMPLE
370 C=CHR$(32):REM BLANK SPACE
380 D=CHR$(46):REM PERIOD
390 E=CHR$(13):REM <ENTER> KEY
400 F="###.#   ":REM PRINT FORMATTER
410 REM *** INSTRUCTIONS
420 PRINT"ROBOT-READER CAN JUDGE THE DIFFICULTY OF ANY TEXT.":PR
INT
430 PRINT"THE RATING IS APPROXIMATELY CORRECT TO WITHIN PLUS OR
MINUS":PRINT"ONE SCHOOL YEAR. FOR GREATER ACCURACY AT BOTH ENDS
OF THE":PRINT"EDUCATIONAL LADDER, TWO DIFFERENT FORMULAE CALCULA
TE
440 PRINT"THE RESULT, WITH A CROSSOVER POINT IN THE SIXTH GRADE.
":PRINT"THE HIGH RANGE FORMULA WAS DEVISED BY A NAVY PSYCHOLOGIS
T,":PRINT"PETER J. KINKAID, AND IS NOW USED BY THE DEFENSE DEPAR
TMENT
450 PRINT"TO SIMPLIFY COMPLICATED TRAINING MANUALS.":PRINT:PRINT
"THIS PROGRAM PERFORMS THE ANALYSIS WHILE YOU TYPE, SO DON'T GO"
:PRINT"SO FAST IT CAN'T KEEP UP. THE RESULT IS GIVEN IMMEDIATELY

460 PRINT"AFTER 100 OR SO WORDS, OR IF YOU <ENTER> AFTER A PERIO
D.

470 PRINT@974,"< ENTER > TO INPUT YOUR SAMPLE";
480 IFINKEY$<>ETHEN480
490 CLS:PRINT"INPUT SAMPLE OF TEXT TO BE GRADED":PRINT
500 PRINT"GO  S L O W.":PRINT"USE A PERIOD AND ONE SPACE AFTER E
ACH SENTENCE.":PRINT"DON'T USE ANY OTHER PUNCTUATION.":PRINT"TO
END, TYPE A PERIOD AND < ENTER >.":PRINT:PRINT"--> ";
510 GOTO20
520 REM  AS A TEST CASE. THE TEXT ON LINES 420-460 YIELDED A
         GRADE LEVEL OF JUST BELOW THE 10TH GRADE.
```

that each vowel represents one syllable. If a double vowel is spotted it is counted only once.

The program remembers the last four letters input. It checks these to see if a word or sentence has just been completed by looking for a space or a period. It also looks for vowel endings that should not be counted as a syllable, such as the *e* in mile or the *ed* in tired.

Using the Program

Use no punctuation except for a period and a single space at the end of each sentence. Don't expect much accuracy if your sample is very short. Each new text may present some problems: Hyphenated words count as one long word unless you skip the hyphen. Should an independent clause be treated as a new sentence? Should you spell out numbers? If your sample is long enough, the result varies little no matter how you resolve these questions.

Though the program gives an analysis whenever you type a period and hit the enter key, it's best to keep typing until Robot counts 100 words. The program terminates your input the next time you finish a sentence. The analysis is instantaneous giving a final grade and also a word count. I shaped the analysis to avoid telling the obvious—if all your words have only one syllable, or you have typed no long words, the program does not give percentages for them. ■

Ed. Note: To run this program on a Model II, 12, or 16, change PRINT@ 974 *in lines 320 and 470 to* PRINT@ (19,17).

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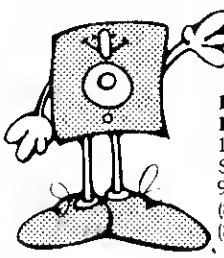

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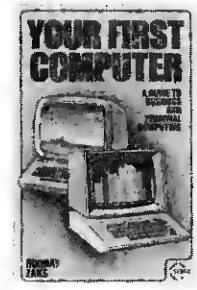

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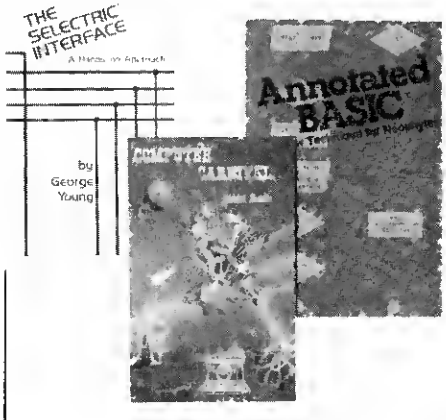

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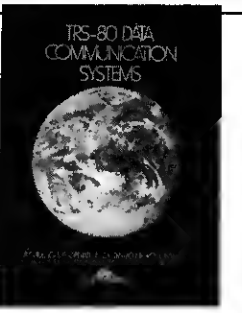

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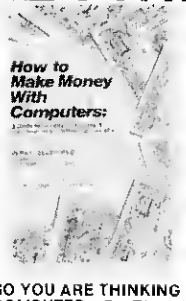

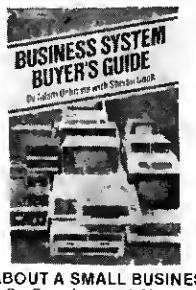

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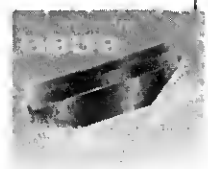

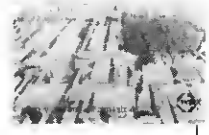

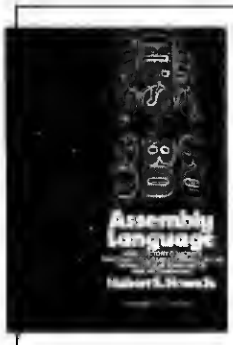

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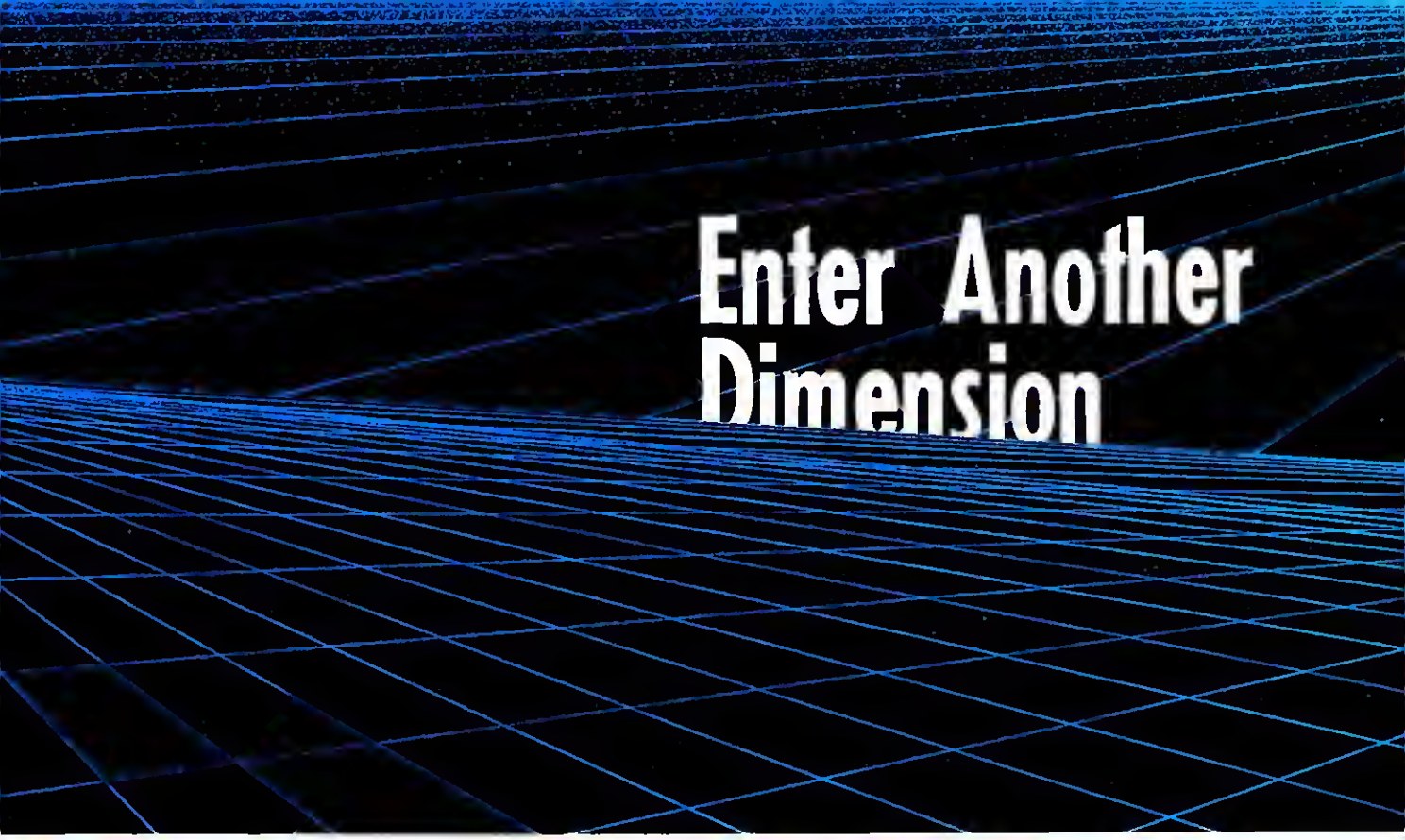

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NEWS THIS MONTH

MICROFLOPPIES

The war is on to shake out a standard for the under 5.25-inch market.

PAGE 310

WHAT, ME WORRY?

Tandy's share of the microcomputer market is declining, but the firm's financial planner says there's no need for alarm.

PAGE 317

ECUM SPIRITU COCO

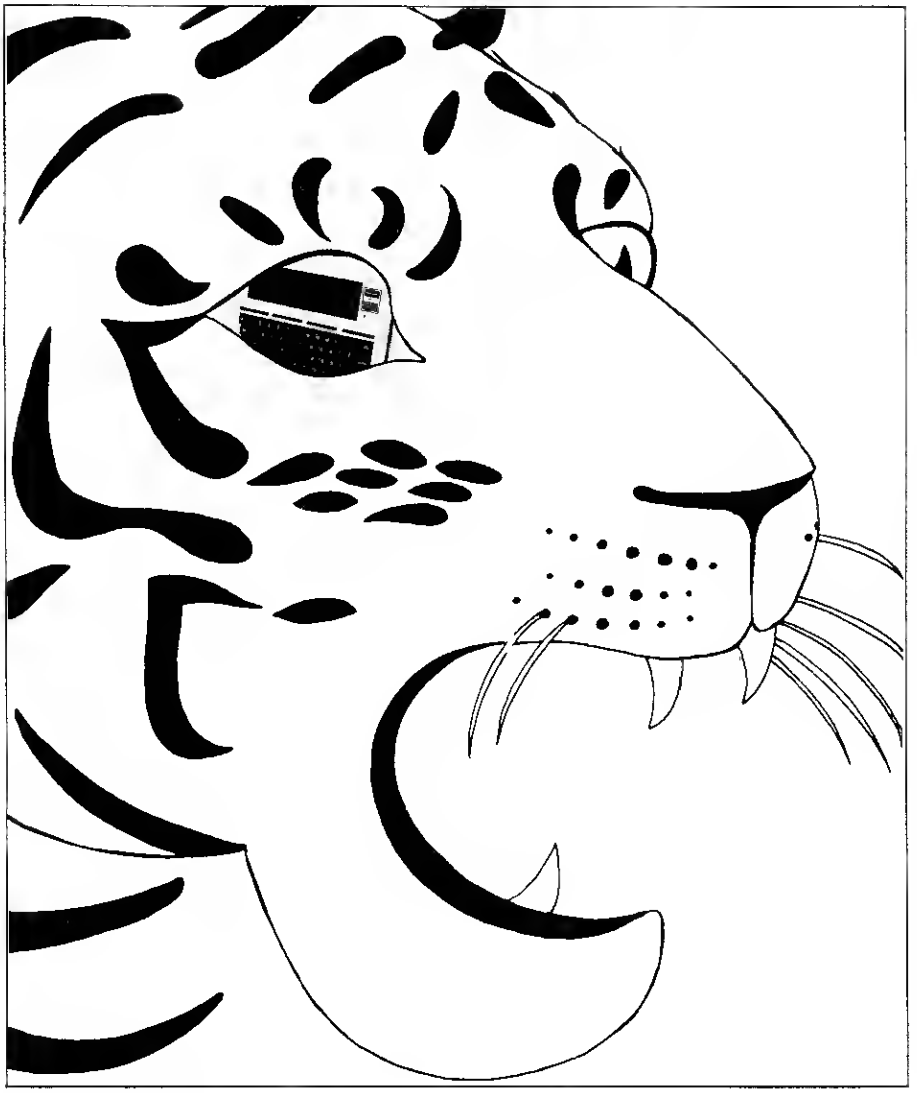
A New York City hacker has developed Color Computer software to enrich the spirit.

PAGE 317

HARDWARE

Eye of the Tiger

Tandy gets it back with the Model 100.



Tandy Corporation made a significant move into the portable microcomputer market by introducing its TRS-80 Model 100 this spring.

According to one industry source, Tandy's invested $180 million in the venture, more than it's ever sunk into a new project. And from the initial reaction of the TRS-80 community, the money was well-invested.

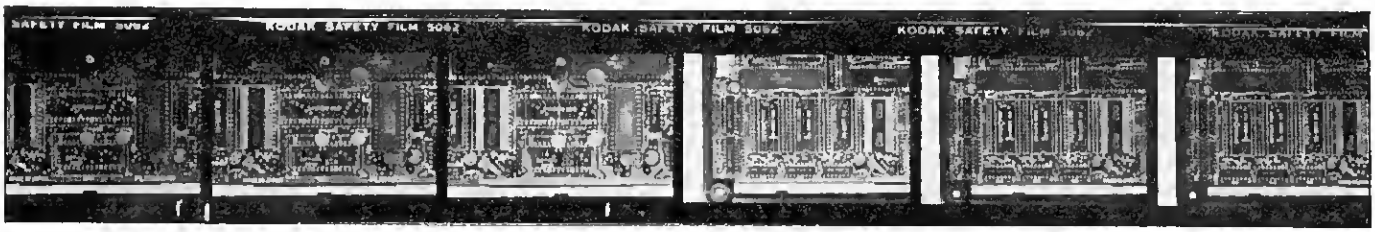
"This will do for the portable market what the Model 1 did for microcomputers," the source said. "Tandy sold 300,000 Model 1's in three years. It will sell that many Model 100s in one year."

The 100 is available in 8K ($799) or 24K ($999). Upgrades, up to 32K, cost $120 for each 8K of CMOS memory.

The portable comes with its own version of Microsoft Basic and four built-in applications programs for word processing, telecommunications, and storing schedules and addresses.

Programmers interviewed by *80 Micro* said the 100's Basic is more powerful than the versions in Tandy's Models I or III. It features:

- A wide-range of input-output statements, allowing a user to access devices like the RS-232C port or eight-line-by-40-character LCD screen;
- Commands to generate music from the 100's five-octave sound generator;
- A Call function allowing Basic to di-



Tandy's Model 100 Micro Executive Work Station may be small outside, but inside it packs quite a wallop.

rectly access machine-language subroutines; and

● Commands allowing program execution to be interrupted when it encounters data from the RS-232 or modem, or senses a function key has been pressed, a time reached, or a certain error has arisen.

The 100 contains a simple word-processing program. A user can insert and delete characters, "cut" and "paste" blocks of text, and search for character strings.

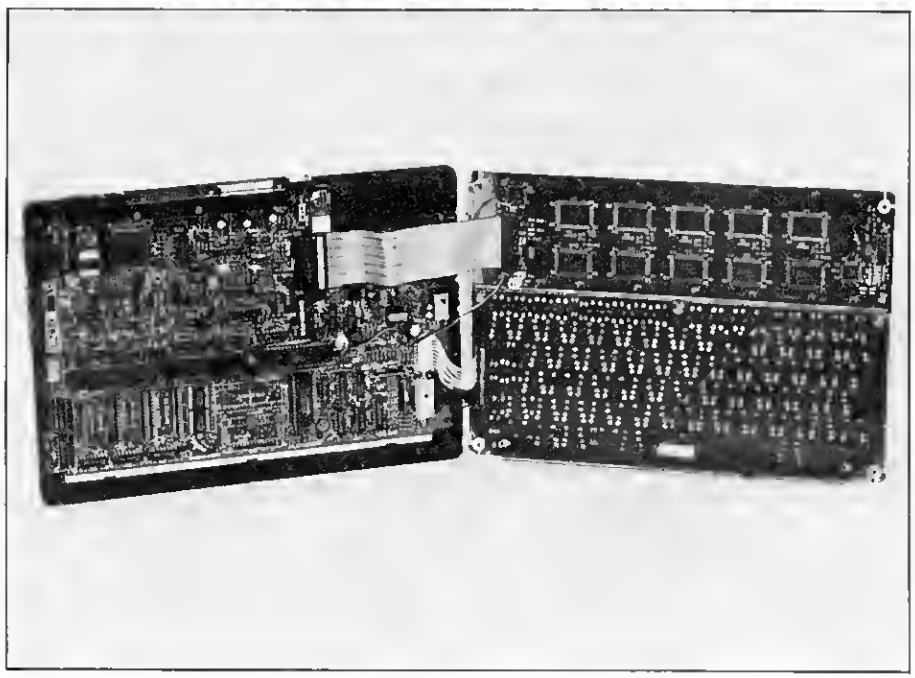
The schedule program acts as a mini-data-base manager. A user can store and search for records. The address program is similar. However, it's linked to the telecommunications program, so if phone numbers are stored with the address, the 100 can dial them automatically.

Telcom also allows the 100 to talk with other computers. It can upload and download files and tap into bulletin boards and data bases. Using Telcom, the 100 can be programed to automatically log a user onto an information system like The Source or CompuServe.

It is powered by four "AA" batteries and has an optional ac adapter. A built-in nickel-cadmium battery recharges itself when the computer's turned on and keeps the memory alive when the computer's off. In an 8K machine, the Ni-Cad will retain what's in memory for 30 days after last power-on. In a 32K unit, memory stays refreshed eight days.

Other features include full-size keyboard, eight programmable function keys, four command keys, four cursor movement keys, a 10-key numeric keypad, built-in modem, RS-232C interface, and parallel printer port.

Next month, *80 Micro* will run an extensive review of the 100. ■



Initial reaction to the 100 indicate it may soon be the star of the Tandy line.

HARDWARE

Microfloppies

Pint-sized disk makers look to market for sub-5.25-inch standard.

BY JOHN P. MELLO JR.
80 MICRO NEWS EDITOR

Half a meg on a 3-inch disk? Or will it be on a 3 and a half-inch disk? Or 3 and a quarter? How about 3.9? Those are the questions confronting benchmark makers at the American National Standards Institute. But it appears they're questions that won't be answered this year.

"I think I would be naive to hope that ANSI would finish all the technical work they need to do to make it official this year," observed Charles Payne.

Payne, business planning manager for Verbatim Corporation, chairs the Microfloppy Industry Committee, an informal panel representing 21 firms backing the 3.5-inch, hard-jacket standard for microfloppies.

One industry newspaper supported Payne's analysis: "Most drive manufacturers we spoke with agreed there would be no movement toward standardization this year...Of course, as the drives and disks come to market, the customers might create a standard by economic persuasion."

If consumers "vote" for a standard with their dollars, some observers believe the firms that get their products into volume production fast and maintain reliability will be very influential on the "economic electorate." One of those firms may be Tabor Corporation, the leading proponent of the 3.25-inch, soft-jacket standard.

Tandon and Shugart (both 3.5-inch supporters) are six months behind us, said Tabor Corporation President Michael Hanley in an exclusive interview with editors at Wayne Green Inc.

However, Tabor is plotting a course into the wind. Of the four lines of microfloppy products being produced, all but Tabor's use hard-shelled disks. And with industry heavies like Shugart, Tandon, and Verbatim lining up behind the 3.5-inch standard, the momentum seems to be behind that benchmark.

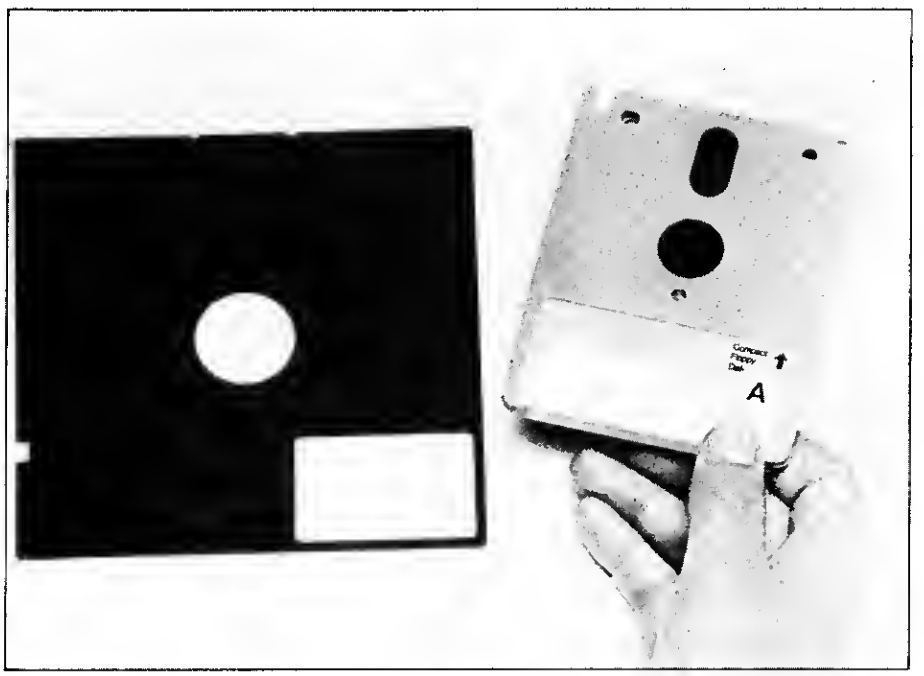
Even if the marketplace establishes the standard, it still may be a year away —if not longer. Most estimates show relatively small volumes of microfloppy products being shipped this year. Dataquest predicts 155,000 drives will be sold in 1983, while Matsushita estimates 1 million microdrives will be sold in 1984, 2 million in 1985, and 4 million in 1986.

A big reason for the slow development of the market is it's tied to the portable computer market, which observers say won't take off until next year.

If microfloppies are primarily used for portables, the 3.5-inch standard—with its hard plastic shell—could gain an upper hand in the market. George Sollman, vice president and general manager of Shugart Associates' sales and marketing division, told one reporter, "People are going to be using these drives in environments where computers are going to be bounced around and you have to take steps to ensure proper protection of the media."

"We were concerned," explained Tom Jarrett, marketing manager for Shugart's microfloppy venture, "about providing as much protection as possible for the media. That led us down the path to the hard jacket."

"There's obviously some market places where you're going to have a high degree of contamination or susceptibility to contamination," Tabor's Hanley admitted. "In that case, it might be the right thing to do to put the disk in a cartridge rather than in a standard floppy."



Three-inch, hard-shelled microfloppy compared to 5.25-inch minifloppy.

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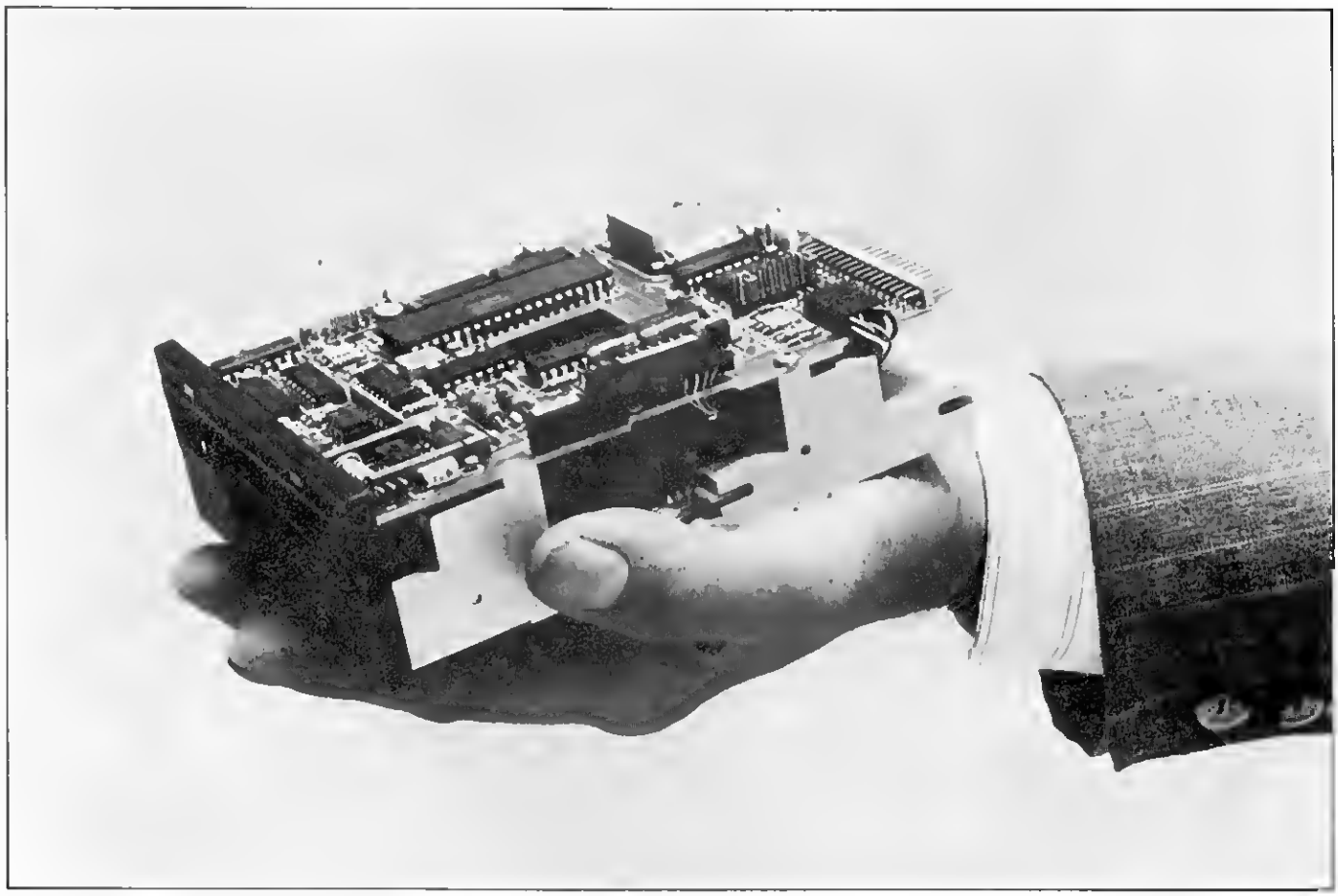


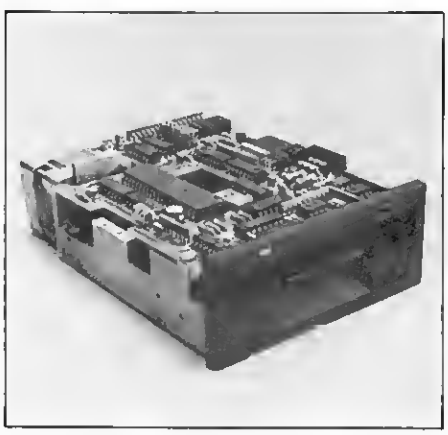
Tabor claims its 3.25-inch disk drive is very reliable.

Microfloppy Committee Chairman Payne said his panel initially favored the soft-jacketed disk. "I have that prejudice," he admitted, "because we [Verbatim] make that kind of product and it would be easier and cheaper for us." But, he said, after surveying Original Equipment Manufacturers and users, the hue and cry was for the hard jacket.

Tabor also talked to manufacturers, according to Hanley. "The manufacturers' major concern," he said, "is they have to buy all new manufacturing equipment to produce the hard shell. It's very expensive. Capital investment is in the range of $2 million."

He claimed, "From the media manufacturer's point of view—with the exception of Verbatim—everyone seems to want to go along with the three and a quarter. But if the Sony [3.5] cartridge gains acceptance, they're willing to go along to get business. They really don't want to do it."

Hanley argued hard-shelled disks



have disadvantages in the price and reliability departments.

He explained soft-jacket floppies have five parts, while one hard-jacket version has 12 parts, another 16. "They've added parts that can go wrong," he said. "That affects reliability."

He sees the hard-jacket's Achilles heel as the door on the outside of the disk. When inserted in the drive, the door opens. While outside the drive, it stays closed to block out contaminants. If that mechanism fails, Hanley contended, there's no way to recover the data.

Shugart's Jarret acknowledged, "The fewer moving parts you have in a drive, the more reliable it tends to become." But he added, "We have some pretty stringent requirements for reliability for [the door] mechanism. The design testing we've done shows it's very reliable." Those tests, he said, show the mechanism still working after 30,000 insertions.

Payne of Verbatim added that since the door mechanism is on the shell's outside, it can be easily pried off and the data recovered from the disk.

Reliability is also a problem with the 3-inch standard, according to opponents of that proposed benchmark. Ironically, why it's a problem is because of an informal goal the industry's agreed upon: a megabyte of storage on a double-sided microfloppy.

"It's a well-engineered product," Payne said of the 3-inch disk. "The

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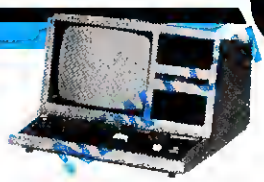

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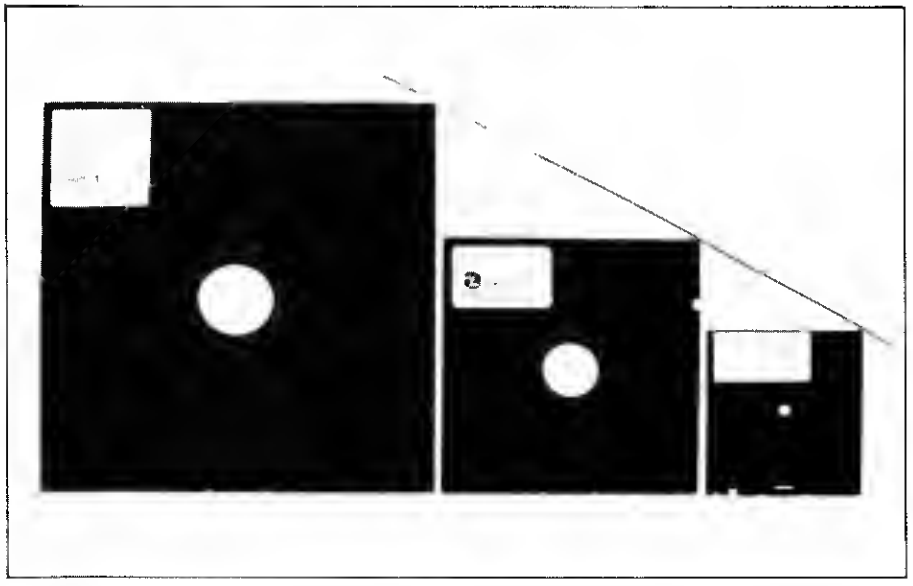
The Lineup: Tabor's 3.25-inch microfloppy compared to 5.25-inch and 8-inch floppies.



only trouble is when you try to get a higher density."

To pack a meg on a 3.5-inch disk, manufacturers use 135 tracks per inch. The 3.25-inch disk has a tpi of 140. The 3-inch makers—now with single-sided storage of 250K at 100 tpi—will have to hike their tpi to 200 to make the one meg goal. "The technical people on the committee and at ANSI just don't believe they're going to do that," Payne said. "If they do do it, we don't think it will be reliable. It's just pushing the technology real hard."

When asked about Payne's remarks, a spokesman for one distributor of Hitachi's 3-inch drive nonchalantly brushed them aside. "I firmly believe and Hitachi believes," said an Amdek Corporation spokesman, "that for reliability, they're practically the same. They don't make inferior products in Japan."

Shugart's Jarret doesn't doubt a one meg 3-inch disk can be made reliable. But he asks, "Is it a cost-effective technology?"

"We can go to 200 tpi," he said. "People are doing it on five and a quarter products. But they're using servo and data-sampling concepts for fine positioning. All that is very expensive to implement."

"If you go addressing more costly technology to achieve certain performance goals," he noted, "you sometimes price yourself out of the market."

Pricing is another point in the 3.25-inch disk's favor, according to Hanley of Tabor. The hard shell, he said, costs 10 percent to 40 percent more to make than the soft shell. He added: "Our sensitivity is to the user. We're trying to keep it as cheap as possible."

"I think they're right in claiming it can be made less expensively in equivalent volumes," Verbatim's Payne acknowledged, "but I don't think there's a prayer there's going to be equivalent volumes. The demand for the hard shell is going to be greater."

Whether it be 3, 3.5, 3.25, or 3.9, microfloppy technology will initially cost more than minifloppies, a prospect inducing some chipsters to turn their backs to the new medium. As one computerist on CompuServe remarked about Amdek's 3-inch disk drives: "Is it worth it? No, unless space is a premium factor. Plus the cost of the non-flexible diskettes make it an unattractive offer at this time."

The fourth entry into the microfloppy sweepstakes is big, slow, incompatible with popular interfaces, and has low storage capacity. Why is it in the running? Verbatim's Payne has an answer to that question: "The really nice thing about that drive is it has IBM's name on it."

Payne said IBM planned to release their 3.9-inch drive with its PC. If that schedule had been followed, he continued, IBM could have established the microfloppy standard. But it wasn't. Now they've got this thing, he noted, with low capacity—a quarter meg on a side—is non-compatible, and is large, slow, and generally, out of date.

"I'm really sorry they [IBM] got into it," he added, "because they have enough weight to drag a part of the industry with them and it's going to fragment the market."

The Big Blue's said it released its drive because it wants to be more than a supplier of computer systems. It wants to provide peripherals to the OEM market, too. But some observers question that rationale.

They maintain IBM, seeing the Japanese 3.5-inch standard gaining ground, decided to throw a monkey wrench into the scheme of things. Tabor's vice president for marketing, George Rea, told one newspaper: "Everyone has gotten a little upset about the fact that it is Sony leading the way. There has been resistance from U.S. companies—including IBM—to having a Japanese company forcing a standard on the U.S. market."

Asked if IBM could hurt its reputation by marketing its 3.9, Verbatim's Payne responded: "I think they will do less well with it than they would with a three and a half inch product, but what could be a major pain for a disk-drive company like Shugart or Tandon probably would be a minor problem for IBM."

As far as IBM is concerned, it was undaunted by benchmark makers when it came to introducing its new product. Hayes Price, OEM marketing and planning manager, told one reporter: "If there had been a standard set, we still would have announced this product. We have had it under development for some time."

Will the four standards survive? Not likely, said Scott Holt, Seagate sales and marketing vice president. He told one newspaper, "I don't believe the market can support the four there today." However, more than one design may survive the coming shakeout. Observed Tandon's product manager Robert Abraham to one reporter, "There probably will be a couple of designs accepted in the marketplace." ■

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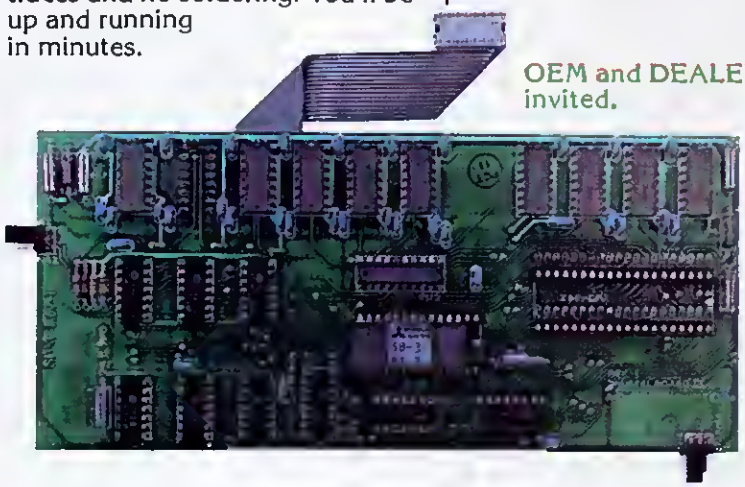

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PULSE TRAIN

Tandy: What, me worry?

After six years of stiff competition, Tandy's share of the computer market has been trimmed to 17 percent. And it could lose another percentage point or two this year, according to *The Wall Street Journal*.

But, *The Journal* reported, Radio Shack maintains losing some of its market share isn't so bad—so long as the total market is booming.

And that seems to be the case. Personal computer sales hit $4.7 billion last year, and are expected to increase about 65 percent to $7.76 billion this year.

"Our experience is that in almost every product category, we lose market share after the boom stage in a market," Tandy's Director of Financial Planning Garland Asher told *The Journal*.

"But we just don't care about market share," he added. "What counts are profits."

While Radio Shack's low-end competition are engaged in cutthroat price-cutting, Asher told the daily, Tandy has refused to further cut the price of its comparable $300 model. "In the next 12 months, we'll lose market share in the low end of the home computer market," the financial planning director said. "But we're simply not going to shoot ourselves in the foot" to make sales.

Still, small-computer sales will constitute an increasing share of Tandy's overall sales, he noted. In the fiscal year ending June 30, the company said it expected 35 percent of its projected $2.5 billion in total sales to come from small computers, up from 31 percent in 1982. Tandy boasts that it expects to be the first of the top three personal computer makers (Apple and IBM are the other two) to reach $1 billion in annual sales from the equipment.

The Journal said Tandy is the only company offering a product in every segment of the small-computer market.

According to the newspaper, Asher doesn't believe radically new hardware will hit the market in the near future. "No one is going to blow the market away with a new piece of hardware at this point," he said, explaining everyone has access to the same hardware components. Rather, he expects to see spinoffs of existing hardware, particularly of IBM's personal computer.

Asher added Tandy may soon fill the niche between its top-of-the-line home computer and personal computers costing $1,000 or more. And he doesn't rule out joining other computer marketers in bringing out a product closely resembling IBM's $2,900 personal computer.

Although Tandy's network of retail stores has given it an edge on competition so far, some people wonder if the company is as well-positioned to sell its small computers to large corporations. That market is growing at a rate of 45 percent or so a year and is expected to account for $1.2 billion in sales of computers by 1983. It's doubtful, *The Journal* said, that purchasing agents of the nation's biggest corporations do a great deal of buying at the local Radio Shack, and Tandy has only 25 national sales representatives.

Rogers: Created program to pray more effectively.

The spiritual CoCo

For Color Computer owners bent on finding Nirvana, New Yorker Alan Rogers has software for you. The 48-year-old producer of TV commercials has created programs on his CoCo for expanding people's spiritual awareness.

Rogers—a true hacker, spending five hours a night developing and refining programs—has been giving away the software, *InfoWorld* reported, although he's paid $20,000 for computer consultants, psychiatrists, and

PULSE TRAIN

cybernetic engineers to evaluate his soulware, and for trips to the West Coast to promote his programs.

However, those costs may soon force him to start charging for his "Infinity Programs." So far, he's given away 200 of them.

Originally, Rogers created Infinity to help people pray more effectively. Then, for people uncomfortable with prayer, he developed other versions to help women develop their intuition, businessmen forecast better, and truth seekers become more meditative.

InfoWorld described the last program as a "generic, all-purpose, nonoffensive" program for people who don't want to make commitments but want to explore the different levels of their minds.

Rogers, born in Canada, likes hawking his software on the West Coast because people there are interested in spiritual things. "New York is so blase you could set off an atom bomb and no one would react," he told the microcomputer weekly.

After loading Infinity—an Eliza program for the soul—your guardian angel, hunch, soul, or spirit commands you to begin. You type in questions and the program replies.

Rogers told *InfoWorld*:

"You contact different levels of the mind, the conscious, subconscious, unconscious, id, ego, higher self, or soul.

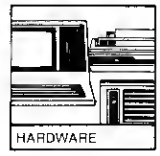
"You become aware of each part of the mind. The system allows you to alter your state of consciousness. In five minutes, you've gone through five levels.

"You get levels of your mind to communicate to you through your fingertips. In a way it's true you are talking to yourself, but it's a higher level of your mind."

Rogers isn't stopping with Infinity. He plans to gather all the information in the world on the mind and computers and create the Mind Computer Research Institute.

And his next software project: use the Bible as a data base to answer users' questions.

Stringy floppy revival



Sporting a new name, the firm that pioneered stringy-floppies has landed support for its technology from one major computer maker and has piqued the interest of two others, including the Tandy Corporation.

The *Electronic News* reported Entropo had licensed Coleco to use the Sunnyvale firm's Microdrive tape cartridge and microwafer technology for the ColecoVision Super Game Module #3 unveiled at the Toy Fair.

It said Coleco would wait until August to market the Entropo technology. Entropo's agreement with Texas Instruments, the weekly reported, allows the Sunnyvale enterprise to manufacture the technology to other companies, but bars them from licensing other firms to make it until mid-1983.

The *Electronic News* said Coleco plans to make portions of the system at its Gloverville, NY, plant and subcontract other portions to Entropo and manufacturers in Taiwan and Japan.

It said Entropo's Coleco system provides 100K of storage and retails for $90. Texas Instruments' "wafer tape" drives cost $139.95. The stringy floppies come in four sizes: 50 feet ($7.95), 25 feet ($6.95), 10 feet ($5.95), and 5 feet ($4.95). The largest size can hold up to 48K of data.

According to the *Electronic News*, Entropo is ramping up its production to meet the demands of Texas Instruments, Coleco and others. It hopes to produce 500,000 drives and 5 million tapes by the end of 1983.

The newspaper also said Entropo is talking to Commodore about customizing a storage system for the VIC-20 and Commodore 64 computers. The president of Entropo, Robert McDonald, served briefly as the president of Commodore's professional computer division, the newspaper said.

Texas Instruments has inked a licensing agreement with Entropo Corporation (formerly Exatron) of Sunnyvale, CA, to use stringy-floppies as mass storage devices for its 99/2 portable computer.

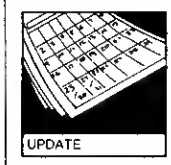
Tandy is also looking at the technology, according to the *Electronic News*. Vice President for Computer Merchandising John Shirley told the weekly, "We're looking at the product. It's pretty high-speed. If they can make it as cheaply as they say they can, it's interesting to us."

The newspaper also reported Coleco had purchased a license to use the stringy-floppy technology. That was denied to *80 Micro* by Mark Yoseloff, executive vice president for Coleco. "The *Electronic News* misstated an awful lot of facts in that article," he said. "Coleco hasn't bought any such license."

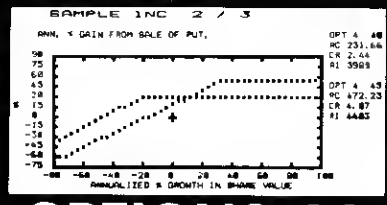
"Coleco is looking at the Entropo technology along with other kinds of mass storage technology," he noted. "We haven't definitely entered into any agreements."

He added, "I think the problem was we used some samples from Entropo to make some samples we showed at the [American] Toy Fair [in New York City]. That in no way implied anything was final or that an agreement had been reached."

Hottest private cools down



Since it's gone public, Altos—the San Jose, CA, computer maker that topped *INC.* magazine's hottest growing private companies (*80 Micro*, April



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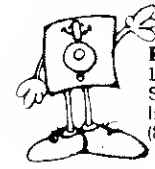

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From the January 1981 issue of the CSRA Computer Club newsletter:

There was some amusement at the November meeting when the Radio Shack representatives stated that the software in the ROM cartridges could not be copied. This month's 68 Micro Journal reported they had disassembled the programs on ROM by covering some of the connector pins with tape. They promise details next month. Never tell a hobbyist something can't be done! This magazine seems to be the only source so far of technical informations on the TRS-80 color computer." Devoted to SS-50 6800 and 6809 machines up to now, 68 Micro Journal plans to include the TRS-80 6809 unit in future issues.

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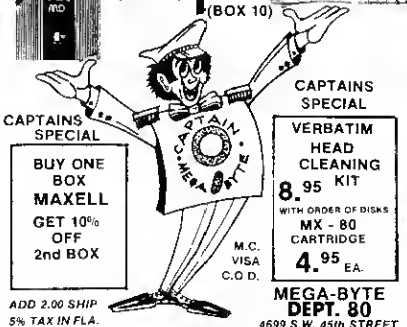

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PULSE TRAIN

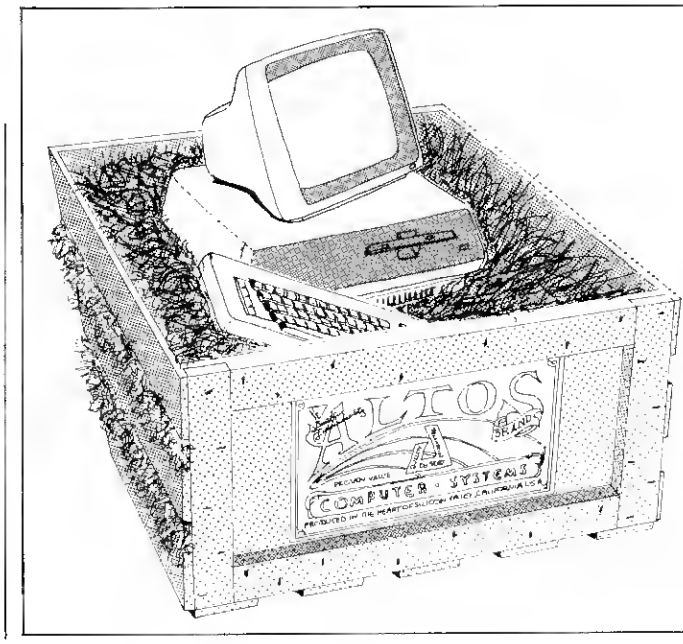
1983)—has experienced a slump in profits and sales.

The slump in profits was attributable to increased advertising costs; increased research, development, and engineering expenses; and additions to the sales force.

Altos said low sales figures were caused by volume production delays of the Model 586 16-bit microcomputer introduced last year and by a major West Coast storm last Dec. 22 causing a one-day power outage at a critical point in the shipping cycle.

Altos Finance Vice President David Zacarias told *Computer Systems News* his firm's projections for its 16-bit machine were too aggressive and optimistic. He said the firm expected 50 of the 586s to be shipped in December. The number actually shipped was significantly less than that.

Wall Street took the company's changed projections and sales shortfall very hard. Altos' initial public offering was $21 a share. Within a month, it was selling at $37 a share. Lately, the stock's been trading at $25 or less.



New CoCos?

END BYTES

Predictions about **NEW TANDY PRODUCTS** abound. In *Creative Creations*, **CLIVE SMITH**, an analyst with the Yankee Group, said expect Tandy to introduce a low-cost replacement for the **COLOR COMPUTER** and a low-cost black-and-white model at $100 to compete with the Sinclair. ■ The **W5YI REPORT** said final figures for 1982 show Timex-Sinclair the winner in the microcomputer unit-sales department with 600,000. The VIC-20 placed second with 400,000, TI's 99/4A third, Atari fourth with 300,000, and the Color Computer fifth with 200,000. ■ On the publishing front, **SCHOLASTIC INC.** has announced two new magazines. *Teaching and Computers*, a monthly magazine for elementary school teachers, will provide "specific, clearly understandable information for classroom teachers." *Family Computing*, slated for September publication, is touted as the first national consumer magazine aimed at families with computers. And for the software publishing industry, **JEFFREY TARTER** is publishing a bi-weekly newsletter called the *Soft●letter* out of Cambridge, MA. ■ **ADAM OSBORNE**, an industry mainstay and man of direct language, laid it on the line about office computers at the Canadian Computer Conference. "You can be one of the first in your office to get one or one of the last," he said, "or you can get a new job." ■ **BOSOM BUDDIES.** After Atari and Imagic settled their differences over the latter's "Demon Attack," the pair appeared to be the best of friends. In a joint statement, the pair said they would be "working together" on game design copyrights, with the goal of developing industry-wide standards. ■ So you thought **COMDEX '82** was big. Well, Comdex '83 will be even bigger, according to its promoters. Last year, the megashow had 3,200 booths. With this year half-gone, 4,600 booths have been sold, and the show's sponsor, the Interface Group, said it's hoping to sell 5,500 booths before the festivities begin November 29. ■ If you like programming, **BRIDGE** may be the game for you. World class bridge player Chip Martel notes that among bridge buffs the most common profession is computing because of the logic required to succeed in the game. ■ In the **TASTELESS GAMES DEPARTMENT**, Wizard Video Games of Los Angeles has developed entertainment based on the film *Texas Chainsaw Massacre*. In the game, the player is Leatherface, who chases people in a field and kills them with a chainsaw. ■ There must have been some red faces at the U.K. fortnightly **MICROSCOPE** when it published its story on the Model 16 using the Xenix operating system. With the piece, the newspaper ran a photo of "Tandy chairman Gates." The pic was of **BILL GATES**, chairman of Microsoft. ■ **GREED** probably accompanies any booming industry, and the microcomputer business is no exception. For that reason, it should not have surprised the editors here when one of our readers requested Bruce Tonkin's address because he thought we'd forgot to publish it with Tonkin's Creator article in January. The reader was crestfallen when informed we had published Tonkin's whereabouts. He had intended to sell the address to other chipsters. ■

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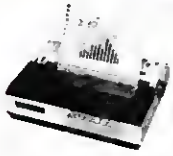

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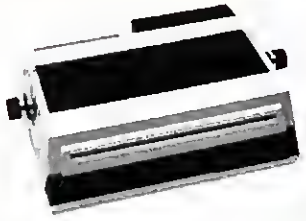

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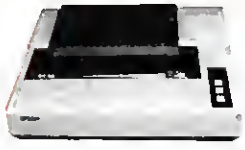

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TAKE II

This column will feature Model II, 12, and 16 conversions of earlier programs. Readers who have converted programs for their own use are encouraged to submit them.

Star Track first appeared in an article by Joey Robichaux entitled "To Boldly Go..." on p. 156 of the 1983 Anniversary Issue of *80 Micro*. This Model II conversion was submitted by Byron Lott, 913 Inverness Way, Sunnyvale, CA.

The program lets you determine the position (right ascension and declination), distance from Earth, angular size, and phase of any planet in the solar system. You can determine the positions of the sun and moon, and their rise and set times. You can calculate precession from the three most common epochs (1950, 1975, 2000), and determine rise and set times for any celestial object. Star Track also helps you convert mean standard time to sidereal time, and vice versa.

Star Track is not so accurate that it considers refractions or planetary perturbations, but it's fine for amateurs.

Dictionary of Terms

Terms introduced in Star Track include: right ascension (RA), declination (DEC), precession, and epoch. The concepts involved are simple, and once you understand them you can locate any celestial object with star charts.

RA and DEC, similar to latitude and longitude, help locate objects in the sky. Latitude refers to how far up or down an object is from the equator. Numbers range from zero to 90 degrees; zero degrees is a point on the equator, while 90 degrees north or south is either of the two poles. Latitude is expressed in degrees, minutes, and seconds; 60 seconds equal one minute, and 60 minutes equal one degree.

Longitude refers to how far around the Earth a point is on its surface. Since no north-south circle exists from which one can measure longitude, Greenwich, England has long been designated zero degrees longitude. Points west of this are west longitude; points east are east longitude. Longitude is also expressed in degrees, minutes, and seconds.

Declination (DEC), is similar to latitude and uses the same reference point, the equator. For example, if the Earth is a spinning ball in the center of a giant sphere, and the circle formed by the Earth's equator were to expand until it touched this celestial sphere, it would trace a great celestial equator. Declination is measured in degrees north and south of this imaginary equator.

Like longitude, right ascension (RA) has an arbitrarily assigned reference point: the vernal equinox, or the first point of Aries. Star charts and positions are computed using this reference point.

Until now, RA and DEC have been almost identical to latitude and longitude. Now RA is expressed in hours, minutes, and seconds instead of degrees, minutes, and seconds. An hour isn't a unit of time here, it's a unit of measure equal to 15 degrees. There are 24 hours in a circle, just as there are 360 degrees in a circle (24*15 = 360).

Right ascension is measured traveling west from the vernal equinox—RA 0h 0m 0s. If you travel 90 degrees to the west, you're at RA 6h 0m 0s. Continue to 270 degrees and you're at RA 18h 0m 0s. When you complete the circle, you're back at RA 0h 0m 0s, so that RA 24h = RA 0h 0m 0s.

Precession applies to bodies that move a certain distance over a set period of time. Some stars move one degree in a particular direction each year; others have a steady precession—their locations or coordinates are always changing.

Star charts are written for particular epochs—currently either epoch 1950 or epoch 2000—since star coordinates aren't the same each year. While neither of the epochs is exactly correct now, the error is slight and doesn't affect amateur observing. Star Track uses epoch 1975 as a compromise between 1950 star charts and 2000 star charts; it refigures coordinates to new epochs.

Using the Program

When you load and run the program, three title pages appear. Each remains on the screen for three seconds while the program loads the necessary variables. The master menu has six options. Selecting option 1 gives you another menu that lets you choose from the nine planets and an option to return to the master menu. Once you select a planet, enter a data in MMDDYY format; use any date from 1950 to 2000.

Star Track then displays the RA and DEC of that planet. Press 1 to see the angular size, phase, and distance from Earth in AU, or press the space bar to return to the last menu.

The menu for option 2 lets you determine the sun's coordinates, distance and angular size, time of sunrise or sunset, or return to the master menu.

If you select option 3 (the moon menu) you are prompted for your approximate latitude. The number should be positive if you live north of the equator, negative if you live south of the equator. This option lets you determine the moon's coordinates, distance, angular size and phase, and rise and set times. When you are prompted for the time, enter it using the military format (i.e., 1800 = 6 p.m.).

Option 4 on the menu lets you convert coordinates to another epoch. The epoch is a four-digit year with an additional decimal digit denoting the parts of the year. So, since June 1982 is halfway through the year, it is entered as 1982.5.

Once you enter the epoch you desire, enter the RA in HHMMSS format and DEC in DDMMSS format. Once again, declinations north of the celestial equator are positive; those south of the equator are negative.

Option 5 lets you convert mean time to sidereal time, and vice versa.

Hints

- All rise and set computations require your approximate latitude.
- Daylight-saving time is not used.
- Once you have entered the date, press enter to following date prompts: that same date will be used. ■

Program Listing

```
10 REM 14-DEC-82 *BDL*
20 REM - PROGRAM ASTROTRK/BAS
30 CLS:CLEAR500:DEFDBLO-Z:DEFINTI-K,M,N:RA=.01745329:RE=23.43*RA:ID!=0:DE$="DEG"
:GOSUB2620:GOSUB2660:GOSUB2670:TH=37.3:U$="###"
40 DIMT1(8),T2(8),T3(8),T4(8),T5(8),T6(8),T7(8),T8(8),T9(8),P$(8),UB(25):UA=.065
709:UC=1.002743:UD=.997257
50 SYSTEM"CLOCK":GOSUB2590
60 PRINT"ASTRO-TRACK MAIN MENU:":PRINT
70 PRINT"1 - DETERMINE PLANET COORDINATES"
80 PRINT"2 - DETERMINE SUN INFORMATION"
90 PRINT"3 - DETERMINE MOON INFORMATION"
100 PRINT"4 - DETERMINE PRECESSION / RISE & SET"
110 PRINT"5 - TIME SYSTEM CONVERSIONS"
120 PRINT"6 - EXIT PROGRAM":PRINT
130 PRINT"ENTER SELECTION";
140 QQ$=INKEY$:IFQQ$<"1"ORQQ$>"6"THEN140
150 I=VAL(QQ$)
160 IFI<1THEN130
170 IFI>6THEN130
180 ONIGOTO190,460,640,910,1210,400
190 CLS:PRINT@20,"PLANET POSITION LOCATOR":PRINT
200 PRINT"MENU:":PRINT:PRINT"1 - MERCURY":PRINT"2 - VENUS":PRINT"3 - EARTH"
210 PRINT"4 - MARS":PRINT"5 - JUPITER":PRINT"6 - SATURN"
220 PRINT"7 - URANUS":PRINT"8 - NEPTUNE":PRINT"9 - PLUTO"
230 PRINT"M - RETURN TO MAIN MENU":PRINT
240 PRINT"ENTER SELECTION";
250 QQ$=INKEY$:IFQQ$="M"THENIP=10:GOTO260ELSEIFQQ$<"1"ORQQ$>"9"THEN250ELSEIP=VAL
(QQ$)
260 IFIP<1ORIP>10THEN240
270 IFIP=10THENCLS:GOTO60
280 IP=IP-1
290 PRINT:PRINT:INPUT"ENTER THE DESIRED DATE (MMDDYY)";D
300 GOSUB2200:IFNO=1THEN290ELSEIFIP=2THEN410
310 S$=P$(IP)
320 ID=IM
330 GOSUB1400:GOSUB1520
340 IFIP<3THENGOSUB1650ELSEGOSUB1710
350 GOSUB1940
360 GOSUB2150
370 PRINT:PRINT"DEPRESS <ENTER> TO RETURN TO LAST MENU, <SPACE-BAR> FOR ANGULAR
SIZE,":PRINT"DISTANCE FROM EARTH, & PHASE OF PLANET";
380 QQ$=INKEY$:IFQQ$=CHR$(13)THEN190ELSEIFQQ$=CHR$(32)THENGOSUB1860ELSE380
390 GOSUB2570:CLS:GOTO190
400 CLS:SYSTEM"CLOCK OFF":PRINT"PROCESSING COMPLETE":PRINT:END
410 FORI=1TO300:NEXT
420 CLS:PRINT:PRINT"ON";D;", THE EARTH WAS LOCATED:"
430 PRINT:PRINT"DIRECTLY UNDER YOUR FEET!"
440 GOSUB2570
450 CLS:GOTO190
460 CLS:PRINT@28,"SUN MENU":PRINT
470 PRINT"1 - DETERMINE COORDINATES OF SUN":PRINT"2 - DETERMINE DISTANCE AND ANG
ULAR SIZE":PRINT"3 - DETERMINE SUNRISE/SUNSET":PRINT"4 - RETURN TO MAIN MENU":PR
INT
480 PRINT"ENTER SELECTION";
490 QQ$=INKEY$:IFQQ$<"1"ORQQ$>"4"THEN490ELSEIP=VAL(QQ$)
500 IFIP=4THENCLS:GOTO60
510 PRINT:PRINT:INPUT"ENTER THE DESIRED DATE (MMDDYY)";D
520 GOSUB2200:IFNO=1THEN510ELSEID=IM
530 ONIPGOTO540,560,580
540 GOSUB1770:GOSUB1940:S$="THE SUN":GOSUB2150
550 GOSUB2570:CLS:GOTO460
560 GOSUB1770:GOSUB1800:GOSUB2530:CLS:PRINT"ON";D;", THE SUN WILL HAVE:":PRINT:P
RINT"AN ANGULAR SIZE OF ";IX;DE$;IY;"'";IZ;"''":PRINT:PRINT"AT A DISTANCE OF "US
ING"##########.";SR;:PRINT" KILOMETERS."
570 GOSUB2570:CLS:GOTO460
580 PRINT:KH=0
590 GOSUB1810
600 TG=TR:GOSUB2540:TM=TG:GOSUB2530:I1=IX:I2=IY:I3=IZ:TG=TS:GOSUB2540:TM=TG:GOSU
B2530:I4=IX:I5=IY:I6=IZ
610 PRINT:PRINT"THE SUN WILL RISE AT APPROXIMATELY ";I1;":";I2;" AM"
620 PRINT:PRINT"     AND WILL SET AT APPROXIMATELY ";I4;":";I5;" PM"
630 GOSUB2570:CLS:GOTO460
640 CLS:PRINT@27,"MOON MENU":PRINT
650 PRINT"1 - DETERMINE COORDINATES OF MOON":PRINT"2 - DETERMINE DISTANCE, ANGUL
AR SIZE, AND PHASE":PRINT"3 - DETERMINE RISE/SET TIMES":PRINT"4 - RETURN TO MAIN
 MENU":PRINT
660 PRINT"ENTER SELECTION";
670 QQ$=INKEY$:IFQQ$<"1"ORQQ$>"4"THEN670ELSEIP=VAL(QQ$)
680 IFIP=4THENCLS:GOTO60
690 PRINT:PRINT:INPUT"ENTER DESIRED DATE (MMDDYY)";D
700 GOSUB2200:IFNO=1THEN690ELSEID=IM
710 PRINT:INPUT"ENTER DESIRED TIME (HHMM=0000-2400, 99 FOR PRESENT),(HHMM)";C
720 IFC=99THENGOSUB2660
730 CH!=INT(C/100):CM=C-CH*100:CM=CM/60:CH=(CH+CM)/24:ID!=ID+CH
740 ONIPGOTO750,770,840
750 GOSUB1770:GOSUB1880:GOSUB1940:S$="THE MOON":GOSUB2150
760 GOSUB2570:CLS:GOTO640
770 GOSUB1770:GOSUB1880:D1=I80-X6+VL:IFD1<0THEND1=D1+360ELSEIFD1>360THEND1=D1-36
0
780 F=(1+COS(D1*RA))/2:IFF>.99THENF=1.0
790 P=(1-.0549^2)/(1+.0549*COS((VM+VC)*RA)):TH=.5181/P:P=P*384401
800 P=INT(P):TM=TH:GOSUB2530
810 CLS:PRINT"THE DISTANCE FROM EARTH IS "USING"######,";P;:PRINT" KILOMETERS"
820 PRINT:PRINT"THE ANGULAR DIAMETER IS ";IX;DE$;IY;"'";IZ;"''":PRINT:PRINT"THE
PHASE IS ";F
830 GOSUB2570:CLS:TH=37.3:GOTO640
840 PRINT:INPUT"ENTER THE OBSERVER LATITUDE (LL.L)";TH:IFTH<0ORTH>90THEN840
850 CH=0:GOSUB1770:GOSUB1880:GOSUB1940:DB=.05*COS((VL-VN)*RA):DA=.55+.06*COS(VM*
RA):XG=XI:XH=XU:XA=XA+(12*DA):XB=XB+(12*DB):GOSUB1940
860 GOSUB1940
870 YB=XG:YA=XH:GOSUB1820:A1=TR:A2=TS:YB=XI:YA=XU:GOSUB1820:B1=TR:B2=TS
880 TR=(I2*A1)/(12+A1-B1):TS=(12*A2)/(12+A2-B2)
890 TG=TR:GOSUB2540:TM=TG:GOSUB2530:I1=IX:I2=IY:I3=IZ:TG=TS:GOSUB2540:TM=TG:GOSU
B2530:I4=IX:I5=IY:I6=IZ
900 PRINT:PRINT"THE MOON WILL RISE AT APPROXIMATELY ";I1;":";I2;":";I3:PRINT:PRI
NT"AND WILL SET AT APPROXIMATELY ";I4;":";I5;":";I6:GOSUB2570:CLS:TH=37.3:GOTO64
0
910 CLS:PRINT@24,"PRECESSION & RISE/SET":PRINT
920 PRINT"MENU:":PRINT:PRINT"1 - DETERMINE PRECESSION FROM YEAR 1950":PRINT"2 -
DETERMINE PRECESSION FROM YEAR 1975":PRINT"3 - DETERMINE PRECESSION FROM YEAR 20
00":PRINT"4 - DETERMINE RISE AND SET TIMES":PRINT"5 - RETURN TO MAIN MENU"
930 PRINT:PRINT"ENTER SELECTION";
940 QQ$=INKEY$:IFQQ$<"1"ORQQ$>"5"THEN940ELSEIP=VAL(QQ$)
950 IFIP=5THENCLS:GOTO60
960 IFIP=4THEN1100
970 IFIP=1THENE1=1950:MS=3.07327:NS=1.33617:AS=20.0426:GOTO1000
980 IFIP=2THENE1=1975:MS=3.07374:NS=1.33603:AS=20.0405:GOTO1000
990 E1=2000:MS=3.07420:NS=1.33589:AS=20.0383:GOTO1000
1000 CLS:INPUT"ENTER DESIRED EPOCH (YYYY.Y)";E:IFE<1950THEN1000
1010 PRINT:INPUT"ENTER RIGHT ASCENSION (HHMMSS)";A:II=INT(A/10000):IFII<0ORII>24
THEN1010
1020 PRINT:INPUT"ENTER DECLINATION (+/- DDMMSS)";B
1030 IX=INT(A/10000):IY=INT((A-IX*10000)/100):IZ=INT(A-IX*10000-IY*100):GOSUB252
0:A1=TM
1040 IX=INT(B/10000):IY=INT((B-IX*10000)/100):IZ=INT(B-IX*10000-IY*100):GOSUB252
0:B1=TM
1050 AD=A1*15:SW=(MS+NS*SIN(AD*RA)*TAN(B1*RA))*(E-E1):SW=SW/3600:TM=A1+SW:GOSUB2
530:I1=IX:I2=IY:I3=IZ:S2=AS*COS(AD*RA)*(E-E1):S2=S2/3600:TM=S2+B1:GOSUB2530:I4=I
X:I5=IY:I6=IZ
1060 PRINT:PRINT"THE ADJUSTED VALUES FOR EPOCH";E;"ARE:"
1070 PRINT:PRINT"RIGHT ASCENSION = ";I1;"H";I2;"M";I3;"S"
1080 PRINT:PRINT"    DECLINATION = ";I4;DE$;I5;"'";I6;"''"
1090 GOSUB2570:CLS:GOTO910
1100 PRINT:INPUT"ENTER THE DESIRED DATE (MMDDYY)";D:GOSUB2200:IFNO=1THEN510ELSEI
D=IM:PRINT:INPUT"ENTER THE OBSERVER LATITUDE (LL.L)";TH:IFTH<0ORTH>90THEN1100
1110 KH=0:PRINT:INPUT"ENTER RIGHT ASCENSION (HHMMSS)";A:II=INT(A/10000):IFII<0OR
II>24THEN1110
1120 PRINT:INPUT"ENTER DECLINATION (+/- DDMMSS)";B
1130 IX=INT(A/10000):IY=INT((A-IX*10000)/100):IZ=INT(A-IX*10000-IY*100):GOSUB252
```

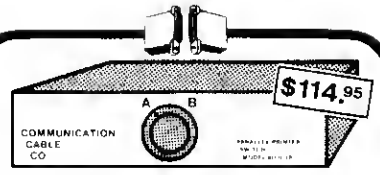
Listing continues

TAKE II

Listing continued

```
0:A1=TM
1140 IX=INT(B/10000):IY=INT((B-IX*10000)/100):IZ=INT(B-IX*10000-IY*100):GOSUB252
0:B1=TM
1150 YB=B1:YA=A1:TW=(-TAN(TH*RA)*TAN(YB*RA)):IFABS(TW)>1THEN1160ELSEGOSUB1820:GO
TO1170
1160 PRINT"THE OBJECT EITHER DOES NOT RISE ABOVE THE HORIZON OR IT IS CIRCUMPOLA
R.":PRINT"IT DOES NOT RISE AND SET!":GOTO1200
1170 TG=TR:GOSUB2540:TM=TG:GOSUB2530:I1=IX+KH:I2=IY:I3=IZ:TG=TS:GOSUB2540:TM=TG:
GOSUB2530:I4=IX+KH:I5=IY:I6=IZ
1180 PRINT:PRINT"THE OBJECT WILL RISE AT ";I1;":";I2;":";I3
1190 PRINT"          AND WILL SET AT ";I4;":";I5;":";I6
1200 GOSUB2570:CLS:GOTO910
1210 CLS:PRINT@25,"TIME & COORDINATES":PRINT
1220 PRINT"MENU:":PRINT:PRINT"1 - CONVERT MEAN SOLAR TIME TO SIDEREAL TIME"
1230 PRINT"2 - CONVERT SIDEREAL TIME TO MEAN SOLAR TIME"
1240 PRINT"3 - RETURN TO MAIN MENU":PRINT:PRINT"ENTER SELECTION";
1250 QQ$=INKEY$:IFQQ$<"1"ORQQ$>"3"THEN1250ELSEIP=VAL(QQ$)
1260 IFIP=3THENCLS:GOTO60
1270 PRINT:PRINT:INPUT"ENTER THE DESIRED DATE (MMDDYY)";D:GOSUB2200:IFNO=1THEN12
70
1280 YY=D-(INT(D/100)*100):IFYY>0ANDYY<74THEN1270
1290 PRINT:INPUT"ENTER THE DESIRED TIME {HHMM=0000-2400, 99 FOR PRESENT},(HHMMSS
)";T
1300 IFIP=1THENIFT=99THENGOSUB2670
1310 CH=INT(T/10000):CM=INT((T-(CH*10000))/100):CS=T-(CH*10000)-(CM*100)
1320 IFCH<0ORCH>24THEN1290ELSEIFCM>59ORCM<0THEN1290ELSEIFCS>59ORCS<0THEN1290
1330 IX=CH:IY=CM:IZ=CS:GOSUB2520:IFYY=0THENYY=25ELSEYY=YY-75
1340 ONIPGOTO1370,1350
1350 UT=UA*KM-UB(YY):IFUT<0THENUT=UT+24
1360 TM=TM-UT:IFTM<0THENTM=(TM+24)*UD:GOTO1380ELSETM=TM*UD:GOTO1380
1370 UT=UA*KM-UB(YY):TM=TM*UC+UT:IFTM>24THENTM=TM-24ELSEIFTM<0THENTM=TM+24
1380 GOSUB2530:IFIP=1THEN1390ELSEPRINT:PRINT"THE CORRESPONDING MEAN SOLAR TIME I
S ";IX;":";IY;":";IZ:GOSUB2570:CLS:GOTO1210
1390 PRINT:PRINT"THE CORRESPONDING SIDEREAL TIME IS ";IX;":";IY;":";IZ:GOSUB2570
:CLS:GOTO1210
1400 OP=(360/365.25)*(ID/T1(IP)):OP=OP-(INT(OP/360)*360)
1410 X1=OP+(360/3.1415927)*T4(IP)*SIN((OP+T2(IP)-T3(IP))*RA)+T2(IP)
1420 IFX1>360THENX1=X1-360ELSEIFX1<0THENX1=X1+360
1430 VP=X1-T3(IP)
1440 XR=(T5(IP)*(1-T4(IP)^2))/(1+T4(IP)*COS((VP*RA)))
1450 X2=SIN((X1-T7(IP))*RA)*SIN(T6(IP)*RA)
1460 X2=ATN(X2/SQR(-X2*X2+1))
1470 X2=X2*57.29578
1480 X3=ATN(TAN((X1-T7(IP))*RA)*COS(T6(IP)*RA))*57.29578+T7(IP)
1490 GOSUB1590
1500 X4=XR*COS(X2*RA)
1510 RETURN
1520 PN=(360/365.25)*(ID/T1(2))
1530 PN=PN-(INT(PN/360)*360)
1540 PL=PN+(360/3.1415927)*T4(2)*SIN((PN+T2(2)-T3(2))*RA)+T2(2)
1550 IFPL>360THENPL=PL-360ELSEIFPL<0THENPL=PL+360
1560 PV=PL-T3(2)
1570 PR=(1-T4(2)^2)/(1+T4(2)*COS(PV*RA))
1580 RETURN
1590 XZ=X1*.05
1600 FORJJ=-360TO360STEP180
1610 XQ=X3+JJ
1620 IFABS(XQ-X1)<XZTHENX3=XQ:RETURN
1630 NEXTJJ
1640 PRINT"ERROR":END
1650 XA=ATN((X4*SIN((PL-X3)*RA))/(PR-X4*COS((PL-X3)*RA)))
1660 XA=(XA*57.29578)+PL+180
1670 IFXA>360THENXA=XA-360ELSEIFXA<0THENXA=XA+360
1680 XB=ATN((X4*TAN(X2*RA)*SIN((XA-X3)*RA))/(PR*SIN((X3-PL)*RA)))
1690 XB=XB*57.29578
1700 RETURN
1710 XA=ATN((PR*SIN((X3-PL)*RA))/(X4-PR*COS((X3-PL)*RA)))
1720 XA=(XA*57.29578)+X3
1730 IFXA>360THENXA=XA-360ELSEIFXA<0THENXA=XA+360
1740 XB=(ATN((X4*TAN(X2*RA)*SIN((XA-X3)*RA))/(PR*SIN((X3-PL)*RA))))
1750 XB=XB*57.29578
1760 RETURN
1770 SN=(360/365.25)*ID:SN=SN-(INT(SN/360)*360):SM=SN+279.041470-282.510396:IFSM
<0THENSM=SM+360
1780 SE=(360/3.1415927)*.01672*SIN(SM*RA):XA=SN+SE+279.04147:IFXA>360THENXA=XA-3
60
1790 XB=0:RETURN
1800 SV=SM+SE:SF=(1+(.01672*COS(SV*RA)))/(1-.01672^2):SR=149595850/SF:S0=SF*.533
128:TM=S0:SR=INT(SR):RETURN
1810 INPUT"ENTER OBSERVER LATITUDE (+/- LL.L)";TH:GOSUB1770:GOSUB1940:IX=I1+KH:I
Y=I2:IZ=I3:GOSUB2520:YA=TM:IX=I4+KH:IY=I5:IZ=I6:GOSUB2520:YB=TM
1820 TW=(-TAN(TH*RA)*TAN(YB*RA)):TW=-ATN(TW/SQR(-TW*TW+1))+1.5708:TW=TW*57.29578
/15
1830 TR=24+YA-TW:IFTR>24THENTR=TR-24
1840 TS=YA+TW:IFTS>24THENTS=TS-24
1850 RETURN
1860 P2=PR^2+XR^2-(2*PR*XR*COS((X1-PL)*RA)):AU=SQR(P2):AT=T8(IP)/AU:WD=XA-X1:AF=
(1+COS(WD*RA))/2:IFAF>.99THENAF=1.0
1870 PRINT:PRINT:PRINT"THE DISTANCE FROM EARTH IS ";AU;"ASTRONOMICAL UNITS (AU)"
:PRINT:PRINT"THE ANGULAR DIAMETER IS ";AT;"''":PRINT:PRINT"THE PHASE IS ";AF:RET
URN
1880 VL=(360/27.3217)*ID1+124.8756:VL=VL-(INT(VL/360)*360):VM=VL-(360/365.25)*(I
D1/8.85)-145.9601:VM=VM-(INT(VM/360)*360):VN=248.6441-(360/365.25)*(ID1/18.61):V
N=VN-(INT(VN/360)*360)
1890 X6=XA
1900 VE=1.274*SIN((2*(VL-XA)-VM)*RA):VA=0.186*SIN(SM*RA):V3=0.37*SIN(SM*RA):VM=V
M+VE-VA-V3:VC=6.289*SIN(VM*RA):VL=VL+VE-VA-VC
1910 VV=.658*SIN(2*(VL-XA)*RA):VL=VL+VV:VN=VN-.16*SIN(SM*RA):XA=ATN((TAN((VL-VN)
*RA)*COS(5.1453*RA)))*57.29578:XA=XA+VN:X1=VL:X3=XA:GOSUB1590:XA=X3
1920 XB=SIN((VL-VN)*RA)*SIN(5.1453*RA):XB=ATN(XB/SQR(-XB*XB+1))*57.29578
1930 RETURN
1940 XB=XB*RA:XA=XA*RA
1950 XT=SIN(XB)*COS(RE)+COS(XB)*SIN(RE)*SIN(XA)
1960 XT=ATN(XT/SQR(-XT*XT+1))
1970 XT=XT*57.29578
1980 X9=(TAN(XA)*COS(RE))-((TAN(XB)*SIN(RE))/COS(XA))
1990 X9=ATN(X9)*57.29578:XA=XA/RA
2000 IFXA<=90THENIQ=1ELSEIFXA<=180THENIQ=2ELSEIFXA<=270THENIQ=3ELSEIQ=4
2010 IFX9<0THENX9=X9+90:GOTO2010
2020 IFX9>360THENX9=X9-90:GOTO2020
2030 IFX9<=90THENJQ=1ELSEIFX9<=180THENJQ=2ELSEIFX9<=270THENJQ=3ELSEJQ=4
2040 X9=X9+((IQ-JQ)*90)
2050 X9=X9/15
2060 IFX9<0THENX9=X9+24
2070 XU=X9:XI=XT
2080 I1=INT(X9):X9=X9-I1
2090 I2=INT(X9*60):X9=(X9*60)-I2
2100 I3=INT(X9*60)
2110 I4=INT(XT):XT=XT-I4
2120 I5=INT(XT*60):XT=(XT*60)-I5
2130 I6=INT(XT*60)
2140 RETURN
2150 CLS:PRINT"ON";D;", ";S$;" WILL BE AT:"
2160 PRINT:PRINT"RIGHT ASCENSION = "USINGU$;I1;:PRINT" H"USINGU$;I2;:PRINT" M"US
INGU$;I3;:PRINT" S"
2170 IFS$="THE SUN"THENIFI4<-23ANDI5>30THENI4=-23:I5=30:I6=0
2180 PRINT:PRINT"DECLINATION = ";I4;DE$;I5;"'";I6;"''"
2190 RETURN
2200 IM=INT(D/10000):'MONTH
2210 ID=INT((D-IM*10000)/100):'DAY
2220 IY=(D-(IM*10000)-(ID*100)):KY=IY:'YEAR
2230 IFIM<1ORIM>12THENNO=1:RETURNELSEIFID<1ORID>31THENNO=1:RETURN
2240 NO=0
2250 IL=INT(IY/4)*4
2260 IFIL=0THENLL=0ELSEIFIL=IYTHENLL=1ELSELL=0
2270 IFIM>2THEN2300
2280 IM=(IM-1)*(63-LL):IM=IM/2
2290 GOTO2320
2300 IM=INT((IM+1)*30.6)
2310 IM=IM-63-LL
2320 IM=IM+ID
2330 IFIY<75THENIY=IY+100
2340 KM=IM
2350 IY=IY-75:IFIY=0THENRETURNELSEIH=1
```

Listing continues



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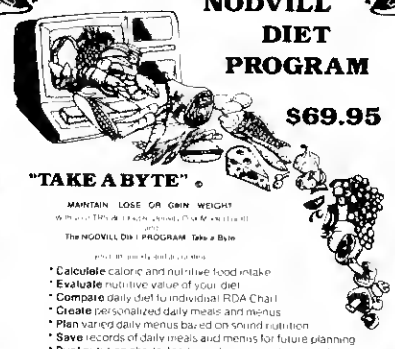

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MAIN Program Menu

(1) Recommended Daily Dietary Allowance (RDA) CHART
(2) 733 Expandable Random Access FOOD LIST Data File
(3) 28 Nutritional MEAL LIST Data File Examples
(4) 7 Balanced DAILY MENU LIST Data File Examples
(5) GROCERY LIST Program Module
(8) 25 Page USER'S MANUAL including Charts and Tables

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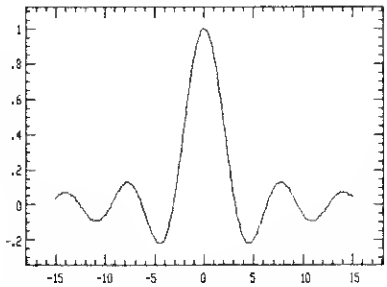

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↙524

TAKE II

Listing continued

```
2360 KM=IM
2370 FORI=1TOIY
2380 IFI=IHTHENIM=IM+366:IH=IH+4ELSEIM=IM+365
2390 IFIH=25ANDI=IHTHENIM=IM-1
2400 NEXTI
2410 RETURN
2420 DATA"MERCURY",.24085,320.66305,77.06645,.205629,.387099,7.00427,48.03493,6.
74,1.918E-6
2430 DATA"VENUS",.61521,310.97453,131.21928,.006785,.723332,3.39428,76.45475,16.
92,1.721E-5
2440 DATA"EARTH",1.00004,99.5343I,102.51044,.016720,1,0,0,0,0
2450 DATA"MARS",1.88089,249.62919,335.59881,.093382,1.523691,1.84983,49.36466,9.
36,4.539E-6
2460 DATA"JUPITER",11.86224,355.21414,13.91992,.04846,5.202804,1.3045,100.19608,
196.74,1.994E-4
2470 DATA"SATURN",29.45771,104.17278,92.55833,.05563,9.538844,2.48933,113.43842,
165.6,1.74E-4
2480 DATA"URANUS",84.01247,205.78286,170.25472,.04725,19.181854,.77316,73.87283,
65.8,7.768E-5
2490 DATA"NEPTUNE",164.79558,249.91462,44.40592,.008586,30.05796,1.77236,131.505
06,62.2,7.597E-5
2500 DATA"PLUTO",246.378,202.3345,224.2580,.246115,39.29976,17.I4451,109.9965,8.
20,4.073E-6
2510 DATA.397221,.413525,.363611,.379644,.395588,.41I473,.36I678,.377595,.393506
,.409421,.359625,.37554,.391454,.407368,.357573,.373487,.389402,.405316,.355521,
.371435,.387349,.403264,.353468,.369383,.385297,.401211
2520 TM=(((IZ/60)+IY)/60)+IX:RETURN
2530 IX=INT(TM):TM=TM-IX:IY=INT(TM*60):TM=(TM*60)-IY:IZ=INT(TM*60):RETURN
2540 W1=KM*UA-UB(KY-75):IFW1<0THENW1=W1+24
2550 TG=TG-W1:IFTG<0THENTG=(TG+24)*UDELSETG=TG*UD
2560 RETURN
2570 PRINT:PRINT"DEPRESS <SPACE-BAR> TO RETURN TO LAST MENU";
2580 QQ$=INKEY$:IFQQ$<>CHR$(32)THEN2580ELSERETURN
2590 PRINT@26,"ASTRO-TRACK":PRINT@180,"STANDBY - LOADING DATA"
2600 FORI=0TO8:READP$(I):READT1(I):READT2(I):READT3(I):READT4(I):READT5(I):READT
6(I):READT7(I):READT8(I):READT9(I):NEXTI
2610 FORI=0TO25:READUB(I):UB(I)=UB(I)+17:NEXT:PRINT@180,"                    "
:RETURN
2620 JA$=MID$(DATE$,7,2):IFLEFT$(JA$,1)=" "THENJA$="0"+RIGHT$(JA$,1)
2630 JB$=MID$(DATE$,11,2)
2640 JC$=MID$(DATE$,16,2):IFLEFT$(JC$,1)=" "THENJC$="0"+RIGHT$(JC$,1)
2650 D=VAL(RIGHT$(JC$+JA$+JB$,6)):RETURN
2660 JX$=MID$(TIME$,1,2):JY$=MID$(TIME$,4,2):C=VAL(JX$+JY$):RETURN
2670 JX$=MID$(TIME$,1,2):JY$=MID$(TIME$,4,2):JZ$=MID$(TIME$,7,2):T=VAL(JX$+JY$+J
Z$):RETURN
```


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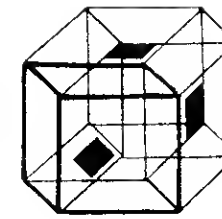

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CALENDAR

June

1–2 Hewlett-Packard, Palo Alto, CA. **Productivity '83** Grand Hyatt Hotel, New York, NY.

1–4 **Sunbelt Educational Computing Conference** Texas Tech University, Lubbock, TX.

3–5 Northeast Expositions Inc., Chestnut Hill, MA. **East Coast Computer Faire** Hynes Auditorium, Boston, MA.

4 North Area Repeater Association, Hopkins, MN. **Computers/Software Swapfest and Exposition** Minnesota State Fairgrounds.

6–8 IEEE Computer Society, Silver Spring, MD. **National Educational Cumputing Conference** Convention Center, Baltimore, MD.

8–10 **Principles of Software Engineering** Ohio State University, Columbus, OH.

9–11 Technical Education Research Centers, Cambridge, MA. **Microcomputers in Education** Watertown, CT.

11–12 Kengore Corp., Franklin Park, NJ. **NJ/NY/CT Microcomputer Show and Flea Market** Meadowlands Hilton Hotel, NJ.

13–16 **PC '83/International Printed Circuits Conference** New York Hilton, New York, NY.

14–15 Hewlett-Packard, Palo Alto, CA. **Productivity '83** Constellation Hotel, Toronto, Canada.

14–16 Electronic Conventions Inc., El Segundo, CA. **Ohmcon/83 Electronic Show and Convention** Detroit, MI.

19–22 IEEE Computer Society, Silver Spring, MD. **12th Annual Computer Elements Workshop** Vail, CO.

19–23 IEEE Computer Society, Silver Spring, MD. **Conference on Computer Vision and Pattern Recognition** Crystal City Hyatt, Arlington, VA.

24–26 **EastCon Games Convention** Glassboro State College, Glassboro, NJ.

26–29 IEEE Computer Society, Silver Spring, MD. **Design Automation Conference** Fontainebleau Hotel, Miami, FL.

26–30 National Computer Graphics Association, Fairfax, VA. **NCGA '83** McCormick Place, Chicago, IL.

27–28 Hewlett-Packard, Palo Alto, CA. **Productivity '83** Sheraton Boston Hotel, Boston, MA.

27–29 London Online Inc., New York, NY. **Videotex '83 Conference and Exhibition** New York Hilton, NY.

27–29 Institute for Professional Development, Princeton, NJ. **Computers in Education '83 Conference** Rutgers State University of New Jersey, New Brunswick, NJ.

July

10–11 **Microcomputers in Music Education** Triton College, River Grove, IL.

18–19 Hewlett-Packard, Palo Alto, CA. **Productivity '83** Westin Hotel, Seattle, WA.

20–22 University of Oregon, Eugene, OR. **Computers in Education Conference** Hilton Hotel and Convention Center, Eugene, OR.

25–28 IEEE Computer Society, Silver Spring, MD. **Softfair Software Development Conference** Hyatt Regency, Crystal City, Arlington, VA.

26–29 University of Illinois at Urbana-Champaign, Urbana, IL. **Computer-Based Music Instruction Workshop** UIUC campus.

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Also, the July *80 Micro* will have you speaking in tongues—or at least in different programming languages, as the issue takes a special look at that topic.

We'll have Cobol studies, a Fortran library routine, a mini-assembler, and a lesson in Assembly-language disk input/output. Richard Sprague's August 1981 race-car game reappears in Forth thanks to Art Wetmore, and Barry Hunt translates Pac-Man into Tiny Pascal.

Getting back to Basic, there's Don Rowe's anticompiler—a program that reverses the compiling process for USR users, producing Basic code from machine language. Karl Townsend offers a tutorial on random access for tape-based systems, and Edward Johnson's utility lets you take time out for mathematical calculations while writing a program. ■

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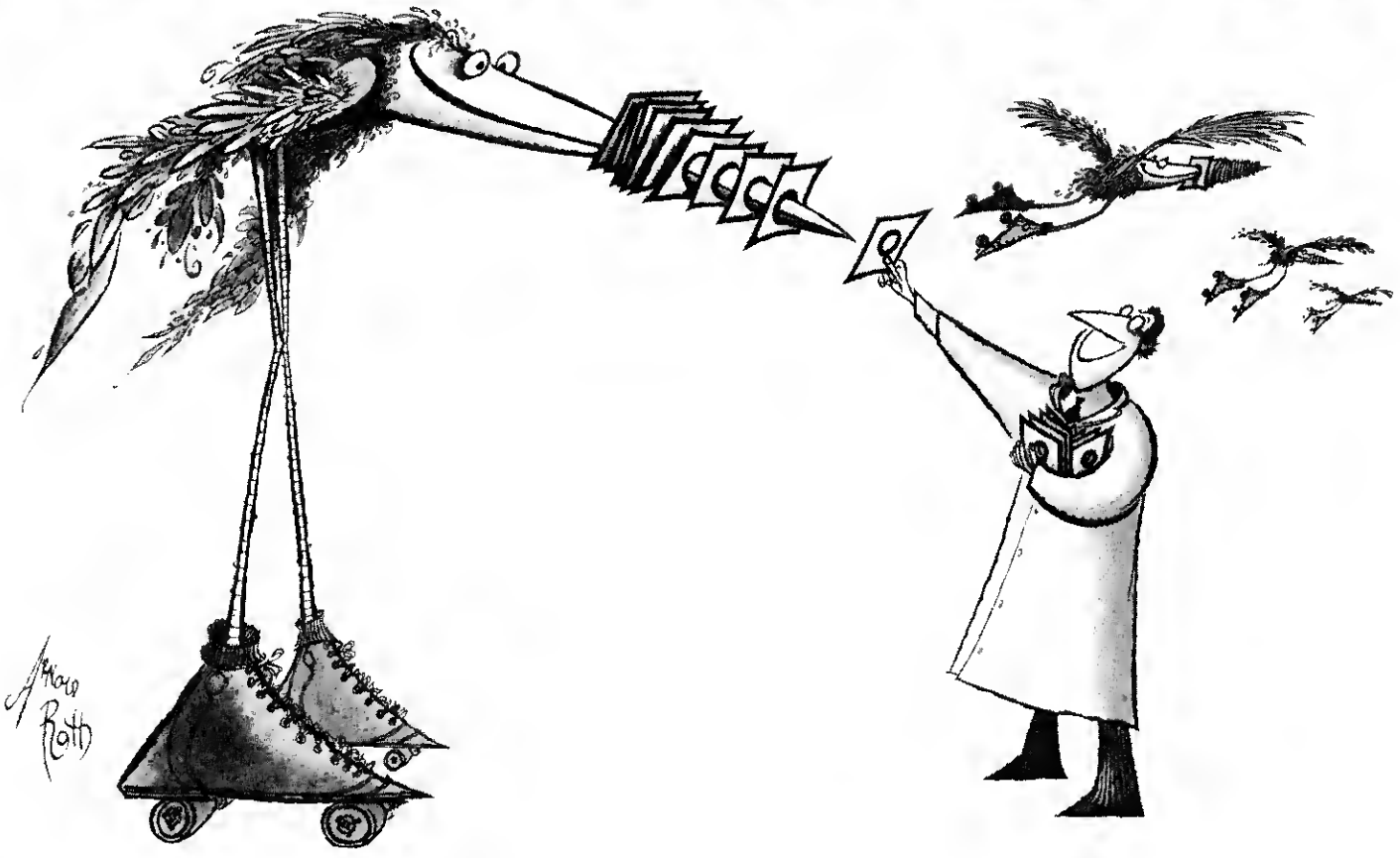

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Child: *I'm sick!*

Parent: *Don't look out the window and get dizzy.*

Child: *I have to go to the bathroom!*

Parent: *How long can you wait?*

Child: *I'm bored!*

Parent: *How about a game?*

To this last suggestion, the child might well reply: *Oh no, not license-plate bingo again!*

Indeed not. This month in the Fun House we're passing out game packets for emergency highway use.

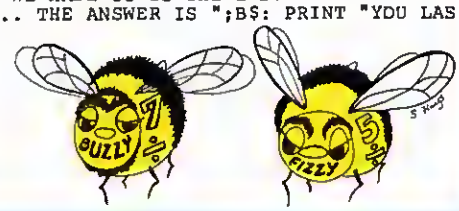
Yes, I know you don't have a computer in the back seat of your car. The idea is to learn games on a computer so you can play them on the highway. Also, one person can play the games with the computer acting as referee, scorekeeper, and sometimes opponent.

All four of this month's programs run in either Level II or on the Color Computer. Only Wordstep needs a bit of modification.

Fizzbuzz

```
100 REM * FIZZBUZZ / TRS-80 LEVEL II OR COLOR BASIC
110 REM * FUN HOUSE / JUNE / RAMELLA
120 CLS
130 PRINT "PREPARE FOR FIZZBUZZ"
140 FOR T=1 TO 1000
150 NEXT T
160 CLS
170 N=1
180 PRINT "WE START WITH THE NUMBER 1..."
190 INPUT "WHO GOES FIRST -- <Y>OU OR <M>E";A$
200 IF A$<>"Y" AND A$<>"M" THEN PRINT "AHEM... I SAID ";: GOTO 190
210 IF A$="Y" THEN G=1 ELSE G=2
220 A$=STR$(N)
230 IF N>19 AND MID$(A$,2,1)="7" THEN B$="BUZZY": GOTO 260
240 IF N>19 AND MID$(A$,2,1)="5" THEN B$=B$+"FIZZY": GOTO 260
250 IF N>9 AND B$="" THEN B$=MID$(A$,2,1)
260 IF N/7=INT(N/7) OR RIGHT$(A$,1)="7" THEN B$=B$+"BUZZ": P=P+1
270 IF N/5=INT(N/5) OR RIGHT$(A$,1)="5" THEN B$=B$+"FIZZ": P=P+1
280 IF P>0 GOTO 300
290 B$=B$+RIGHT$(A$,1)
300 IF G=1 THEN PRINT "MY TURN": FOR T=1 TO 600: NEXT: PRINT B$: G
OTO 350
310 IF G=2 THEN PRINT "YOUR TURN": INPUT Z$
320 IF Z$=B$ THEN PRINT "RIGHT!"
330 IF N=99 THEN PRINT "WHEW! WE MADE IT TO THE END. WELL DONE!"
340 IF Z$<>B$ THEN PRINT "NO... THE ANSWER IS ";B$: PRINT "YOU LAS
TED"N"NUMBERS.": END
350 IF G=1 THEN G=2 ELSE G=1
360 P=0
370 B$=""
380 N=N+1
390 GOTO 220
400 END
```

This game runs on the Model 100



Fizzbuzz

This is the shortest and trickiest program of the month. You've probably played the game called Buzz. In it, you and one or more other players start counting, but you must say

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Taffy

```
00 REM * TAFFY / TRS-80 LEVEL II OR COLOR COMPUTER
110 REM * FUN HOUSE / JUNE / RAMELLA
120 CLS
130 CLEAR 500
140 DATA HANDY,BROWN,JUMPS,QUICK,RUSTY,SANDY,WORTH,SMILE,FOXES,H
UMAN
150 DATA GUILT,POINT,GNOME,FOUND,HEAVY,MOIST,GAMES,SCORE,ROUND,B
OARD
160 DATA DEPTH,WORLD,WIDTH,SMACK,WRECK,UNDER,BELOW,FORT,CRUST,BA
KER
170 DATA BLOCK,THYME,SNAIL,BROAD,BIRDS,SLUMP,ELBOW,BRAIN,CLEAR,T
RUCK
180 DATA MONEY,SPICE,CHILD,EXACT,GHOST,SCARE,RIGHT,REPLY,BINGO,W
ATCH
190 FOR A=1 TO 32
200 X$=X$+"*"
210 NEXT
220 N=1
230 DIM A$(50)
240 FOR B=1 TO 50
250 READ A$(B)
260 NEXT
270 C=RND(50)
280 PRINT "I HAVE THOUGHT OF A WORD."
290 PRINT "TAKE YOUR FIRST GUESS."
300 PRINT X$
310 PRINT "GUESS"N;
320 INPUT D$
330 IF LEN(D$)<>5 THEN PRINT "YOU MUST GUESS 5-LETTER WORD.": GO
TO 310
340 IF D$=A$(C) THEN PRINT "YOU WIN IN"N"TRIES.": END
350 FOR A=1 TO 5
360 FOR M=1 TO 5
370 IF MID$(D$,M,1)=MID$(A$(C),A,1) THEN P=P+1
380 NEXT M
390 NEXT A
400 PRINT "TRY NUMBER"N"--"P"POINT";
410 IF P>1 THEN PRINT "S" ELSE PRINT
420 IF N=30 GOTO 460
430 N=N+1
440 P=0
450 GOTO300
460 PRINT X$
470 PRINT "30 TURNS UP. I AM SO SORRY."
480 PRINT "I WIN. THE WORD WAS "A$(C)
490 PRINT
500 PRINT "TO PLAY AGAIN, TAP ENTER."
510 INPUT X
520 N=1
530 GOTO 270
540 END
```

Wordstep

```
100 REM * WORDSTEPS / TRS-80 LEVEL II
110 REM * TO ADAPT FOR COLOR COMPUTER, SEE LINE 630
120 REM * FUN HOUSE / JUNE / RAMELLA
130 CLS
140 CLEAR 500
150 DIM B$(14)
160 A=RND(21)+64
170 IF A=81 OR A=84 OR A=75 OR A=57 OR A=73 OR A=74 OR A=57 GOTO
 160
180 PRINT "YOUR WORDSTEP LETTER IS..."
190 PRINT
200 PRINT "         "CHR$(A)
210 PRINT
220 PRINT "TAP ENTER. THEN YOU HAVE"
230 PRINT "UNTIL THE TIMER REACHES 100"
240 PRINT "TO BUILD YOUR WORDSTEP."
250 INPUT X
260 CLS
270 Z=64
280 C=2
290 N=1
300 B$(1)=CHR$(A)
310 PRINT B$(1)
320 A$=A$+INKEY$
330 PRINT @ Z,A$;"                ";
```

Wordstep continues

buzz if the number has a 7 in it or is evenly divisible by seven.

Fizzbuzz is like that, only more so. You also have to say fizz if the number ends in a 5 or is evenly divisible by five.

There are more rules, so put on your thinking cap. Let's start by counting to 10 according to the rules: 1, 2, 3, 4, FIZZ, 6, BUZZ, 8, 9, FIZZ. The number 5 has a 5 in it, and the number 10 is evenly divisible by five, so they are fizzes. The number 7 has a 7 in it, so it's a buzz.

Above 10, it gets trickier. The number 14 would be 1BUZZ; you say the first number and buzz because 14 is divisible by seven. In the same way, 15 is 1FIZZ.

The number 35 has a 5 in it and is also divisible by seven, so it's 3BUZZFIZZ.

Oh, did I say that numbers beginning with 5 start with FIZZY, as in FIZZY1 for 51? And did I mention that numbers starting with 7 begin with BUZZY, as in BUZZY8 for 78?

I could tell you more, but I'll let you find BUZZYBUZZFIZZ, FIZZYBUZZ, and BUZZYBUZZ on your own.

You don't have to know how to play to start. The computer plays against you—perfectly, of course—and the object is to see how close to the number 99 you can get.

To start, the computer asks who will play first. Enter Y if the computer plays first or M if you want first turn. Then the count begins. Whenever you make a mistake, the computer tells you the answer and invites you to play again.

Fizzbuzz could use up quite a few miles, couldn't it? Also,

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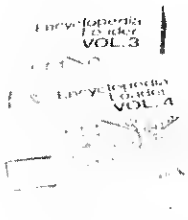

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Wordstep continued

```
340 H=H+1
350 PRINT @ 15,"TIMER:"INT(H/50);
360 IF C=15 OR H=5000 GOTO 540
370 IF LEFT$(A$,1)<>CHR$(A) THEN A$="": GOTO 320
380 IF RIGHT$(A$,1)="/" THEN A$="": GOTO 320
390 IF RIGHT$(A$,1)=CHR$(13) AND LEN(A$)=<C THEN A$="": GOTO 320

400 IF LEN(A$)>C AND RIGHT$(A$,1)<>CHR$(13) THEN A$=LEFT$(A$,C):
 GOTO 320
410 IF LEN(A$)=C+1 AND RIGHT$(A$,1)=CHR$(13) THEN B$(N)=A$: A$="
": GOTO 430
420 GOTO 320
430 CLS
440 PRINT @ 0,CHR$(A)
450 F=1
460 FOR G=64 TO Z STEP 64
470 PRINT @ G,B$(F);
480 F=F+1
490 NEXT
500 Z=Z+64
510 C=C+1
520 N=N+1
530 GOTO 320
540 PRINT @ 416,"";
550 IF H=5000 THEN PRINT "TIME IS UP...";
560 IF C>5 THEN Z$="GOOD"
570 IF C>8 THEN Z$="EXCELLENT"
580 IF C>10 THEN Z$="AMAZING !"
590 IF C>14 THEN Z$="THE BEST !!!"
600 PRINT@ 480,"SCORE:"C-1"-"Z$;
610 GOTO 600
620 END
630 REM ********************************
640 REM * TO ADAPT FOR COLOR COMPUTER,
650 REM * ENTER FOLLOWING LINES:"
660 REM *       270 Z=32
670 REM *       460 FOR G=32 TO Z STEP 32
680 REM *       500 Z=Z+32
690 REM *       520 PRINT @ 448,"";
700 REM ********************************
710 END
```

Essay

```
100 REM * ESSAY / TRS 80 LEVEL II OR COLOR BASIC
110 REM * FUN HOUSE / JUNE / RAMELLA
120 DATA THIS SUMMER,I,RAN,TO,THE FARM,DANCED WITH,RED,MARTIAN
130 DATA IN JULY,MY DAD,DROVE,TOWARD,DISNEYLAND,GAVE A HAMBURGER T
O,YOUNG,COW
140 DATA GUESS WHAT?,MY MOM,TOOK A TRAIN,AWAY FROM,VENUS,PLAYED FO
OTBALL WITH,CRABBY,LADY
150 DATA NOT LONG AGO,MY DOG,FLEW,INTO,CHINA,RESCUED,WORRIED,BOY
160 DATA JUST FOR FUN,OUR CAT,SWAM,OVER,A SUPERMARKET,SEWED A SHIR
T FOR,SILLY,ELF
170 DATA ONLY LAST WEEK,MY FRIEND ELMO,CRAWLED,THROUGH,THE PACIFIC
 OCEAN,TOLD STORIES TO,SILLY,ELF
180 CLEAR 700
190 CLS
200 PRINT "ESSAY: MY SUMMER"
210 PRINT
220 X=6
230 DIM A$(X),B$(X),C$(X),D$(X),E$(X),F$(X),G$(X),H$(X)
240 FOR A=1 TO X
250 READ A$(A),B$(A),C$(A),D$(A),E$(A),F$(A),G$(A),H$(A)
260 NEXT
270 G$=A$(RND(X))+" "+B$(RND(X))+" "+C$(RND(X))+" "+D$(RND(X))+" "
+E$(RND(X))+" AND "+F$(RND(X))+" A "+G$(RND(X))+" "+H$(RND(X))+".
"
280 FOR N=1 TO LEN(G$)
290 H$=MID$(G$,N,1)
300 PRINT H$;
310 FOR T=1 TO 40
320 NEXT
330 O=O+1
340 IF O>15 AND H$=" " THEN PRINT: O=0
350 NEXT N
360 GOTO 270
370 END
```

learning the game on a computer will make you a Fizzbuzz expert.

Taffy

This word game isn't about candy. It's called Taffy because of the way you pull words apart and put them together as you play.

The computer has a list of 50 words from which it chooses a secret five-letter word that you must guess within 30 tries. That list is in data lines 140–180. It is best that all the letters of your guess word be different.

The computer gives you one point for each letter in your guess word that matches the secret word. You might have two points in one turn and none in the next. The computer gives you clues about letters in its word.

A good way to play is to write out the alphabet. Using logic, cross out letters that do not seem to be in the secret word. In time, if you're good at this, you'll guess the five letters. Then you must guess the letters in the right order—the secret word—to win.

Notice that all the secret words have no repeated letters, so it's to your advantage to guess with words that don't repeat letters either.

Wordstep

This is an easily played but tough-to-beat game. If your computer runs in Level II, type the program to line 620 END and stop.

If you have a Color Computer, do the same thing, then retype lines 270, 460, 500, and 520 as they are given at the bottom of the program where it says, "To adapt for Color Computer, enter following lines:".

In Wordstep, the computer shows you a starting letter. First, you type a two-letter word starting with that letter, then a three-letter word, then a. . .you get the idea.

You have until the timer reaches 100 to create a wordstep ending in a 14-letter word. All words must start with the letter you're given at the beginning.

The program plays referee. It refuses words that are the wrong lengths or don't start with the correct letter. To erase a try that's no good, type /, the slash mark on the same key with the question mark. To register a word, tap enter.

If you reach a 14-letter word, you have my sincere congratulations.

Essay

I know summer vacation is just beginning, so maybe this isn't the time to talk about going back to (yuck) school in September.

Even so, now is the time to gather material for the first task your teacher will give you when you return: the What-I-Did-This-Summer essay.

To show you how much fun an essay can be, I've written an essay generator. There are no rules, thank goodness. You just run it and read it. Every time it should be different.

This morning a very large crate was delivered to the Fun House. On it was a sign that said *Materials for July Fun House Visit.* I wonder what's inside. Be here to open it next month. ■

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by Amee Eisenberg

Load 80's new transfer system

Load 80 has a new disk-transfer system! This means that Load 80 disks boot on both the Model I and III and let single-drive users transfer Load 80 files without begging or borrowing a second drive.

To use the new disks, transfer their files to your TRSDOS system or data disk as follows:

- Back up a TRSDOS disk and purge it of any old visible files.
- Insert the Load 80 disk in drive zero of your Model I or III.
- Press the reset button. After your computer boots the Load 80 disk, it displays the Load 80 logo for a moment, and then a list of programs on the disk appears.
- Two-drive users: Insert your TRSDOS disk in drive 1. This is the destination disk and drive.

Single-drive users: When the computer prompts for the destination drive, press the zero key. The computer then tells you to mount the destination disk.

- If there is not enough space on the disk to transfer all files, the computer offers to transfer only the files you specify. The computer won't transfer a file if there isn't enough room on the destination disk.
- Two-drive users: The computer transfers the files, reports on each file as it does, and tells you when it's finished.

Single-drive users: Swap the source and destination disks one time for each file transferred, and one more time to transfer the directory. The computer prompts you through the procedure, but be careful not to confuse your source and destination disks.

One final point: Because the new Load 80 disks contain both single- and double-density tracks, you can't back up this disk. However, once you've transferred the files, you can (and should) back up the disk you've created.

Old Business

Last month, Art Huston began discussing the differences between TRSDOS and DOSPLUS. Let's continue with the Build and Do commands.

These commands let you build a list of DOS commands and then process them in order. A sample application would be to take a directory, turn on the clock and enter Basic every time you boot-up.

The syntax for building a file is:

BUILD filename

If you don't specify an extension, the file is given an extension of /BLD. Then type as many DOS commands as you want, pressing enter after each. To end the build session and return to DOSPLUS, press break. To extend a file, type "BUILD filename" again. You cannot edit a Build file; you must kill and then reconstruct it.

To execute a Build file, type:

DO filename

The default extension is /BLD. Each DOS command is executed in order.

You may want to use the Auto command to do a file each time you press reset.

The Pause command is included to halt the operation of a Build file until the operator presses enter. The syntax is:

PAUSE message

The Basic included on DOSPLUS is compatible with TRSDOS in all but one respect: The proper command to go from Basic to the operating system is CMD, not CMD"S". ■

Index	Page	Article	File Spec	Comments
A			COPYRGHT/BAS	None
B	330	Fun House	FIZZBUZZ/BAS	None
C	330	Fun House	WORD/BAS	None
D	330	Fun House	TAFFY/BAS	None
E	24	The Next Step	NXTSTEP/BAS	None
FEA	24	The Next Step	NXTSTEP/SRC	Ed/Asm
GEA	68	Drivers and DCBs	FLASH/SRC	Ed/Asm
H	68	Drivers and DCBs	FLASHDIRS/BAS	None
IEA	78	Apple Core Emulator	APPLE/SRC	Ed/Asm
JEA	78	Apple Core Emulator	AP6502SM/SRC	Ed/Asm
KEA	116	The 80 Goes Color—Part II	COLORIO/SRC	Ed/Asm
L	116	The 80 Goes Color—Part II	COLORDMO/BAS	None
M	246	Flowchart Generator	FLOW/BAS	None
N	302	Robot Reader	ROBOTRDR/BAS	None
O	300	Ordering via Recursive Routines	PERMOFN/BAS	None

Note: All programs indexed with a letter followed by EA need an editor/assembler (Ed/Asm).

June 1983 Load 80 Directory

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My vote for the best advertisement in this issue goes to _____(company) whose Reader Service number is_____.

A. How much have you invested in computer software during the last 12 months?
- ☐1. Nothing
- ☐2. Less then $100
- ☐3. $100–$250
- ☐4. $250–$500
- ☐5. $500–$1,000
- ☐6. Over $1,000

B. How do you acquire most of your software?
- ☐1. From software houses
- ☐2. From magazines
- ☐3. From friends and other programmers
- ☐4. Program it myself
- ☐5. Copy it

C. Where do you buy most of your computer hardware?
- ☐1. Radio Shack store
- ☐2. Other computer/electronics store
- ☐3. Department store
- ☐4. Mail order
- ☐5. Used equipment dealer
- ☐6. Private individual

D. What type of TRS-80(s) do you own?
- ☐1. Model I Level I
- ☐2. Model I Level II
- ☐3. Model II
- ☐4. Model III Level I
- ☐5. Model III Level II
- ☐6. Model 16
- ☐7. Model 12
- ☐8. Color
- ☐9. Pocket

E. How much have you invested in computer hardware (including peripherals) during the last 12 months?
- ☐1. Nothing
- ☐2. Under $1,000
- ☐3. $1,000–$2,000
- ☐4. $2,000–$3,000
- ☐5. $3,000–$4,000
- ☐6. $4,000–$5,000
- ☐7. Over $5,000

F. How much do you plan to spend on computer hardware (including peripherals) during the next 12 months?
- ☐1. Nothing
- ☐2. Under $1,000
- ☐3. $1,000–$2,000
- ☐4. $2,000–$3,000
- ☐5. $3,000–$4,000
- ☐6. $4,000–$5,000
- ☐7. Over $5,000

G. Which of the following peripherals do you plan to buy during the next 12 months?
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- ☐2. Modem
- ☐3. Plotter
- ☐4. Joystick/Game Paddles
- ☐5. Light Pen
- ☐6. Voice Synthesizer
- ☐7. Disk System
- ☐8. Expansion Interface
- ☐9. Monitor

H. Do you ever write Assembly-language programs?
- ☐1. Yes
- ☐2. No

I. Do you invest in the stock market?
- ☐1. Yes
- ☐2. No

J. The articles in 80 Micro are:
- ☐1. Too simple
- ☐2. Too complex
- ☐3. Just right

L. Which of the following columns do you read? Please rate them on a scale of 1 (seldom read) to 5 (always read).
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- ___2. Commander 80
- ___3. The Gamer's Cafe
- ___4. News
- ___5. Copernico Mathematica
- ___6. MONEY DOS
- ___7. Fun House
- ___8. Feedback Loop
- ___9. The Color Key
- ___10. The Next Step
- ___11. Suite 16
- ___12. Medical Opinion

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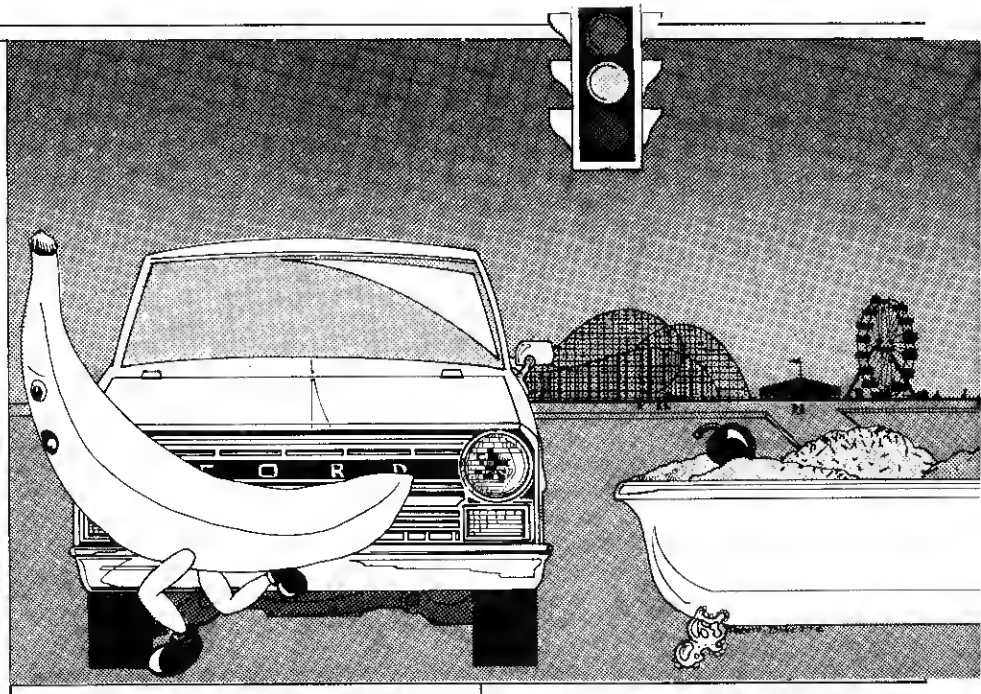
The GAMER'S CAFE

by Rodney Gambicus



Strictly from hunger

Sandusky, OH, Spring 1983. A battered yet beaten old van sits on the beach at Cedar Point beneath an azure morning sky. Across the bay lies the amusement park, its pinnacles of pleasure pasted to the horizon. An occasional burst of gaiety from the ferris wheel wafts across the sand, tickling the nose of the van before drifting out to sea.

The van's door slides open. A man, known to his comrades only as Mad Max, steps out, dressed in shorts and reflecting sunglasses. He stretches, inhales deeply the pungent breeze.

"Ah. . .I love the smell of Erie in the morning!" he says.

"I'm hungry. What do we have to eat around here?" Mercedes asks as she emerges from the van.

"You're always hungry," I reply. "For heaven's sake, we ate just last week."

"Let's go into town and get some food," she continues.

I smile. The witty repartee amuses me. But why are hundreds of little hamburgers emerging from the sand?

I hear strains of Wagner music. From the causeway? The hunger! The hunger!

* * * * *

I am driving. Mercedes sits next to me. Max is in the back playing Cosmic Fighter. We are cruising down Columbus Avenue.

"I'm worried about Max," Mercedes says. "I mean, ever since that Ken Jackway blew him off the board in Cosmic Fighter, he's been acting very weird."

Max screams.

"He seems OK to me," I say.

"It's impossible! 581,280 can't be done!" he cries.

"There's a store," I hear Mercedes say. "Let's stop and get some peanut butter and crackers."

Suddenly, a giant banana runs across the road. Six guys with a bathtub full of ice cream are chasing it. The banana is whimpering, and I am profoundly disturbed.

* * * * *

We are sitting on a park bench, munching our crackers. We didn't have enough money for peanut butter. In front of us is a statue of a boy holding a boot from which water pours. He is laughing at us.

Mercedes reads the mail. "Take a look at this one," she says. "This guy Rich Fiore has figured out how to cheat at Poltergeist and Microbes.

" 'On Level I of Poltergeist, if you hold down either joystick button, few or no cars will appear. On Level II, I've noticed that it is possible to walk through the obstacles and even the Poltergeist! In Microbes you can cheat by pressing the shift and @ buttons at the same time when the prompt 'What's your name?' is displayed. Your ship rotates faster and shoots more often.'

"He also wants some tips on how to get out of Pyramid."

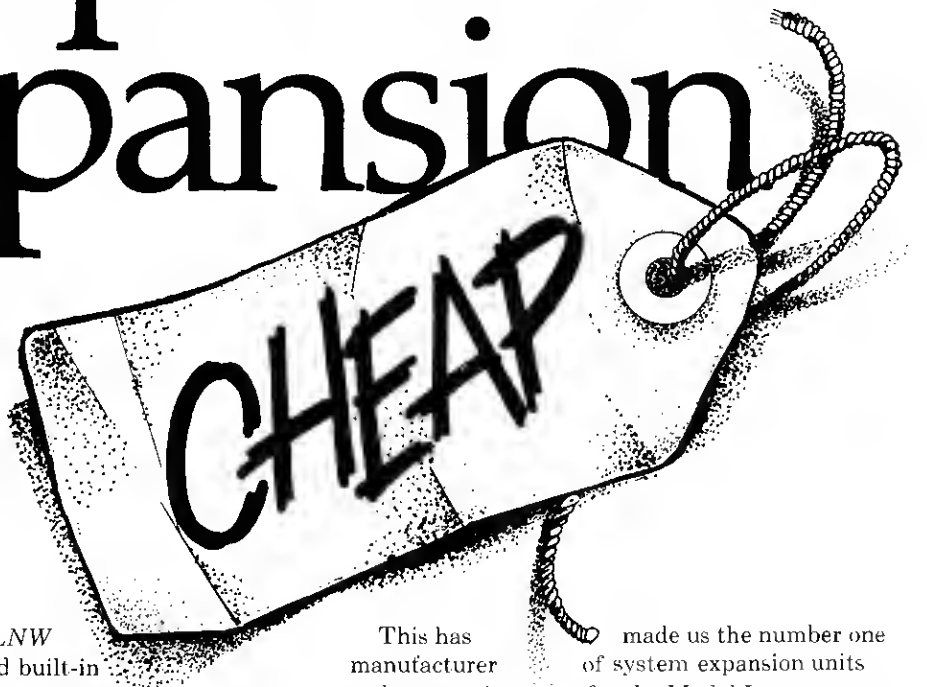
Max is indignant. "Cheat on your taxes, cheat on your exams," he spits through his crackers. "But cheat on a game? My God! Has he no honor? I hope he never finds his way out of Pyramid!"

Max is a harsh man, I think, as I watch him trample a cluster of M&Ms scurrying across the pavement.

```
10 CLS:PRINT"PRESS ANY KEY WHEN <ELIMINAT/CMD> IS IN DRIVE"
20 IF INKEY$=""THEN 20
30 CMD"LOAD ELIMINAT/CMD"
40 INPUT "DO YOU WANT (R)APID FIRE OR (N)ORMAL";A$
50 IF A$="N"THEN GOTO1000
60 POKE-28483,0
100 INPUT"HOW MANY SHIPS DO  YOU WANT (1-99)";S$
110 IFLEN(S$)=1THEN POKE-29778,VAL(S$):GOTO140
120 POKE-29778,S
130 POKE-19679,ASC(LEFT$(S$,1)):POKE19653,ASC(LEFT$(S$,1))
140 POKE 19678,ASC(RIGHT$(S$,1)):POKE-19652,ASC(RIGHT$(S$,1))
150 INPUT"HOW MANY BOMBS DO YOU WANT (1-99)";B$
160 IFLEN(B$)=1THENPOKE:29773,VAL(B$):GOTO190
165 B=VAL(RIGHT$(B$,1))+VAL(LEFT$(B$,1))*16
170 POKE-29773,B
180 POKE-19670,ASC(LEFT$(B$,1)):POKE-19662,ASC(LEFT$(B$,1))
190 POKE-19669,ASC(RIGHT$(B$,1)):POKE-19661,ASC(RIGHT$(B$,1))
200 DEFUSR1=-29927:C=USR1(0)
```

Eliminator patch by Greg Hanssen (Honolulu, HI). Runs on Model I under NEWDOS80.

Expensive Expansion



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*8" drive operation requires special cable. 8" double-density requires 3.55MHz CPU speed-up modification or LNW-80 4MHz computer.

* * * * *

I have finally topped Dean Mitchell's high score of 271,300 in Eliminator.

"Anybody can get 500,000 with 99 ships and 99 bombs," says Mercedes scornfully.

We are in the parking lot at the Cedar Lanes bowling center. The lot is empty except for the van, our computers on card tables, and 500 square-dancing eggplants.

"You aren't actually going to publish this program, are you?" Max asks.

"Sure," I say. "It's just another tomato in the chef's salad of computing."

"This is disgraceful!" he bellows. "First we let cheaters give tips in the column. Now we tell everybody how to get as many ships and bombs as they want in Eliminator! It's anarchy! It's a sham! It's the end of civilized gaming as we know it!"

Max starts quoting long passages from Toynbee and Emerson, and I turn my attention to the weather. It is raining lentil soup.

* * * * *

"Hey, let's at least finish off the scoreboard," grumbles Mercedes.

"What about my high scores in Bable Terror and Time Runner?" says Max.

"You're just upset because John Hope deep-sixed your Sea Dragon score," Mercedes replies.

"Ah, that's a wimpy game anyway," Max mutters.

"This Richard Uglum got 74,800 in Donkey King," Mercedes reads from the pile of letters.

I am distracted by an English muffin crawling out of the PMC's disk drive.

"He says there's an error in the second barrel screen," Mercedes continues. "You can go under the first barrel by jumping out from under it. Problem is, you sometimes get points."

I grab the muffin and start eating it.

"Rodney," says Mercedes. "How come you're chewing on Armored Patrol?"

* * * * *

Midnight. We are roaring down the Ohio Turnpike. The hum of dark thoughts is in our ears. We are headed east, but sunrise is still hours away. The roadside reflectors dance like moths in the corner of my eye. Mercedes sleeps, her head on the armrest of the door. Max is in the back, quiet for once; the only spaceships he battles are the headlights in the westbound lane.

We are on the road again. How we managed isn't important; suffice it to say that we reached the end of a fantasy, and there found food and fuel.

Still, the night is unsettled. It flickers like a failing screen, inhabited by video ghosts of uncertainty, inhibited only by the will of its guests. The aliens that surround us, that linger on the fringes of our glow, are patient. Only occasionally do we hear them, their laughter echoing across the bay of darkness from a causeway we cannot see.

I shudder, take another sip of coffee, and step on the gas. The van hesitates and then leaps forward, and we continue our journey on the crest of the phosphorescent wave. ■

The Big Board

Alien Defense	91,320	Carl Pflanzer, Gillette, NJ
Armored Patrol	81,000*	Winthrop
Astro Blast (CC)	15,225	Andrew Puglise, Aliquippa, PA
Attack Force	153,470	Mark Brinkman, Emporia, KS
Bable Terror	7,858	Mad Max
Bounceoids	2,028,450	Scott McClure, Winter Park, FL
Caterpillar	95,644	Matthew Holmes, Nelson, N.Z.
Chicken	8,922	Halfdan Hansen, Nelson, N.Z.
Cosmic Fighter	581,280	L. Ken Jackway, Phoenix, AZ
Defense Command	126,170	Bette Dufraine, Bolton, CT
Demon Seed	77,970	Christopher Healey, Falmouth, MA
Donkey King (CC)	74,800	Richard Uglum, Milwaukee, WI
Eliminator	271,300	Dean Mitchell, Edmonton, Alta.
Flying Saucer	1,270**	James Oh, Pebble Beach, CA
Fortress	187,600	Mark Brinkman, Emporia, KS
Galactic Attack (CC)	41,340	Rich Fiore, Clemson, SC
Galaxy Invasion	7,185,230+	James & Richard Oh, Pebble Beach, CA
Galaxy Invasion Plus	1,113,600	Geordon Portice, Twining, MI
Ghost Hunter	41,190	John Kane, Nelson, N.Z.
Jovian	133,320	Mark Brinkman, Emporia, KS
Laserball	72,530	Neil Matson, Panama City, FL
Laser Defense	199,490	Matthew Holmes, Nelson, N.Z.
Liberator	306,300	Rodney
Lunar Lander	9,600	Nelson Kruger, Duarte, CA
Meteor Mission 2	63,520	L. Ken Jackway, Phoenix, AZ
Meteroids (CC)	25,270	Andrew Puglise, Aliquippa, PA
Microbes (CC)	69,400++	Rich Fiore, Clemson, SC
Missile Attack	41,430	John Kane, Nelson, N.Z.
Monkey Kong (CC)	746	Andrew Puglise, Aliquippa, PA
Monster Maze (CC)	14,340	Rich Fiore, Clemson, SC
Outhouse	26,650	Halfdan Hansen, Nelson, N.Z.
Pac Attack (CC)	56,235	Andy Lehtola, Mound, MN
Paddle Pinball	861,680	James Oh, Pebble Beach, CA
Planet Invasion (CC)	57,500	Andrew Puglise, Aliquippa, PA
Polaris (CC)	53,879	Rich Fiore, Clemson, SC
Poltergeist (CC)	4,840	Rich Fiore, Clemson, SC
Robot Attack	14,780	James Oh, Pebble Beach, CA
Scarfman	303,580	Raimo Hansen, Mesa, AZ
Sea Dragon	552,890	John Hope, Kingston, Ont.
Space Castle	37,650	Mark Brinkman, Emporia, KS
Stellar Escort	53,350	Geordon Portice, Twining, MI
Storm (CC)	170,775	Andrew Puglise, Aliquippa, PA
Super Nova	1,166,340	Mark Brinkman, Emporia, KS
Swamp Wars	39,200	Winthrop
Time Runner	89,479	Mad Max

* Mohan Ramaswamy (Altamonte Springs, FL) reports 368,000. He doesn't say whether it was Method I or II.
** Played at the highest level.
+ Solo record: 2,026,850 (Nelson Kruger, Duarte, CA).
++ Level 6.

Gamer's Cafe readers are invited to submit their high scores, for these and other TRS-80 games. We'll print unvalidated scores, but validated ones (a photo of the screen) will, of course, rank higher in prestige.

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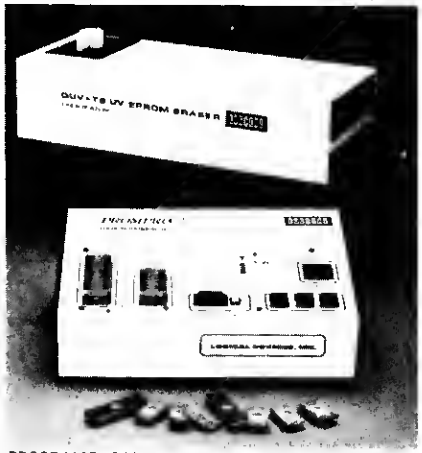

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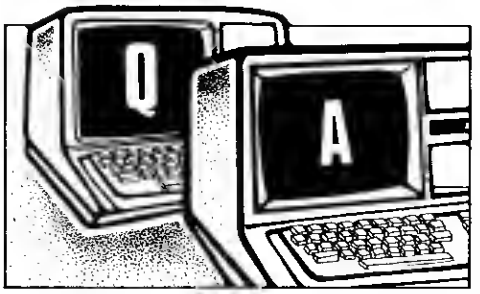
by Terry Kepner



Problems and solutions

Send any questions or problems dealing with any area of TRS-80 microcomputing to Feedback Loop, 80 Micro, *80 Pine St., Peterborough, NH 03458.*

I own a Model I and I would like to speed up the Z80 clock. Many articles in 80 Micro *offer speed-up kits boasting increases of up to 150 percent. The circuits shown have a bunch of flip-flops and logic gates. My question is: If the Z80 operates at 4 MHz, why hasn't anyone come up with the idea to exchange the crystal in the clock circuit for a 4 MHz crystal? Also, why did Tandy decide to have the TRS-80 operate at 1.77 MHz instead of the top speed of 4 MHz?*

J.L.
Lowell, MA

The reason RS doesn't replace the present crystal with a 4 MHz crystal is because the present crystal has a 10.6445 MHz frequency. The logic gates and flip-flops are used to divide this 10 MHz frequency down to the desired frequency. The chips in the TRS-80 can't be used without extensive modifications to the circuit board, so most speed-up kits use their own divider networks to do this.

Tandy didn't design the TRS-80 for 4 MHz operation because it's expensive. Consider that you'd have to use 200-nanosecond RAM chips to operate at that frequency, which are more expensive than the 300-nanosecond chips originally used. Also consider that the other chips in the computer would have to be upgraded to higher quality, and higher priced, chips before the full speed could be achieved. In fact, several of the speed-up kits warn you that in order to reach the higher speeds it may require replacing several key chips with ones of higher quality (such as replacing the Z80A chip with a Z80B).

Designing the TRS-80 to operate at 4 MHz would have increased the production cost as much as 20–50 percent. Since the designers were interested in making it as inexpensive as possible, they decided to use the cheaper chips and a slower clock rate. The machine was originally designed for the home hobbyist and not the business or scientific community, so the slower speed doesn't matter. After all, in most cases the TRS-80 is waiting for people, printers, modems, and other slower devices to do their stuff before it can proceed with its job.

At present I own 10 of Scott Adams' 12 adventures, loaded from tape to disk. I did this by using Jake Commander's Macro Monitor and copying the programs from 8000H–BCFFH and adding a loader at BCFFH to BD0F to load it over the overlay region after being put in memory by the DOS.

I've tried many times, unsuccessfully, to replace the cassette save and load routines with disk save and load routines and relocating the programs to 7000H–ACFF so that the DOS isn't destroyed. Do you know of a patch that can do this?

C.J.
Monaca, PA

I remember trying to do that myself several years ago. Unfortunately, I couldn't get it to work for me either. I suggest that you contact Adventure International and ask about trading in your cassette programs for disk programs.

I own a Model III and would like to use the Superzap utility to change some files and to transfer Model I programs. Would you please suggest some books that define in detail the Model III disk structure? Books such as TRS-80 Disk and Other Mysteries *appear to be written for the Model I.*

L.S.
Maple Glen, PA

The IJG book (IJG Inc., 1953 West 11th St., Upland, CA 91786) was written before there was a Model III on the market. Fortunately, most of the information about the directory in *TRS-80 Disk and Other Mysteries* also applies to the Model III, although there are differences. *The Alternate Source* had an article in issue 12 (Vol. II, No. 6) entitled "Reconstructing Model III TRSDOS Directory Entries" that details the differences between the Model I and Model III directories. The single issue is no longer available, but you can buy it bound with issues 7 to 12 in TAS Volume II for $19.95.

Additional information on the general structure of Model III files can be found in an article entitled "Supercop" in issue 11 which is also included in the TAS Volume II.

I have two TRS-80 systems: System A is a 48K Model I with a single-density, single-sided 40-track drive, and system B is a 32K Model I with a single-density, single-sided 35-track disk drive.

For some reason, system B won't go to Basic. When I type Basic in at the DOS Ready prompt, Basic appears for a few seconds, and then either reboots or locks up. I've tried two 40-track DOSes and one 35-track DOS. Basic is stored on tracks below track 35, so the lack of the upper five tracks shouldn't cause any problems. What makes this confusing is that all my machine-language programs load properly.

I don't suspect the keyboard and interface because when I switch disk drives to the 40-track drive from the other system, Basic loads just fine. The Radio Shack repairman insists that nothing is wrong with the 35-track drive. What could be the problem?

R.G.
North Hollywood, CA

The first thing that occurs to me is: What stepping speed are you using with your DOSes? The 35-track drives sold by Radio Shack can't step as rapidly from track to track as most of the 40-track drives on the market.

I once had a similar problem with a friend's computer. My disk wouldn't go into Basic on his system, but worked fine with mine. I finally realized that my

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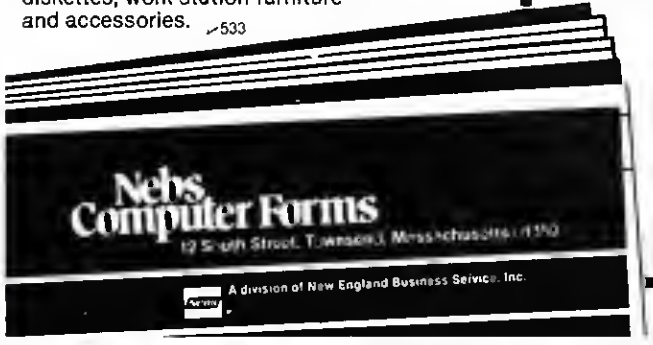

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DOS was using a track-to-track stepping time of 3 milliseconds, but his drives were slower and required a stepping speed of 12 ms. When my DOS was on his computer, it kept expecting data back from the drive before the drive could get it to the DOS. The result: Data Lost, Track not Found, and similar error messages. When I increased my DOS's stepping rate to 12 ms, the problem disappeared completely. Try this and let me know if it works.

I own an early TRS-80 Model I, Level II computer which won't execute the USR command. I've been told that this isn't an isolated incident. Does anyone have a way around this problem?

T.M.
Rural Hall, NC

I checked with my technical friends and none of them have ever heard of any problems with the USR function not working. The FC error means that the address you've given for the location of the machine-language routines location isn't where the machine-language routine is really located. You've either miscalculated the routine location (hexadecimal to decimal conversion error) or you haven't given the right Memory Size to protect the routine from Basic.

First, make sure that you're not using the Disk Basic command DEFUSR to tell Basic the location of your routine. It won't work in Level II Basic.

Second, make sure that you haven't reversed the numbers in the USR address. 16526 must contain the least significant byte (LSB) of the machine-language routine's address, and 16527 must contain the most significant byte (MSB) of the address. They must be POKEd into memory in that order.

And last, make sure your math conversion routines are giving you the correct addresses. If you have the decimal address, divide it by 256 to get the decimal value of the MSB. Throw away the portion that's to the right of the decimal place, and then convert that number to hexadecimal using the table in your Level II manual. Subtract the decimal MSB (multiplied by 256, of course) from the decimal address of the routine to get the decimal value of the LSB, and then look up the hexadecimal value. Now that you have the values in hexadecimal, work them backwards to get the decimal address you started with. Any difference means you've made an error and need to double check your math.

If you're interested, type in Program Listing 1. It's a simple, quick, and dirty program for converting from decimal to hexadecimal and back again. Not very structured or elegant, but it'll do the job.

```
10 CLS:CLEAR500
20 PRINT:INPUT"HEXADECIMAL OR DECIMAL NUMBER (H/D)";A$
30 IF A$="H" THEN 270
40 IF A$<>"D" THEN 20
50 INPUT"DECIMAL ADDRESS";A$
60 IF A$="" OR VAL(A$)<1 OR VAL(A$)>65535 THEN50
70 A=VAL(A$)
80 IF A<256 THEN A1=A : E=0 : M$="00" :GOTO150
90 D=INT(A/256)
100 IF D>16 THEN E=INT(D/16) ELSE E=0
110 F=D-E*16
120 X=E : GOSUB250 : M$=X$
130 X=F : GOSUB250 : M$=M$+X$
140 A1=A-D*256
150 IF A1>16 THEN B=INT(A1/16) ELSE B=0
160 C=A1-B*16
170 X=B : GOSUB250 : L$=X$
180 X=C : GOSUB250 : L$=L$+X$
190 PRINT"LSB =";A1
200 PRINT"MSB =";D
210 PRINT"HEXADECIMAL NUMBER = ";M$+L$
220 PRINT"LSB = ";L$
230 PRINT"MSB = ";M$
240 RUN20
250 IF X<10 THEN X$=CHR$(X+48):RETURN
260 X$=CHR$(X+55):RETURN
270 INPUT"HEXADECIMAL NUMBER";A$
280 IF A$="" OR LEN(A$)>4 THEN 270
290 C=0 : FORI=LEN(A$)TO1 STEP-1
300 B$=MID$(A$,I,1)
310 IF B$<"0" OR B$>"F" OR (B$>"9" AND B$<"A")
    THEN PRINT"ERROR IN HEXADECIMAL NUMBER":STOP
320 IF B$>"@" THEN A=ASC(B$)-55 ELSE A=VAL(B$)
330 IF A>0 THEN B=A*16[(LEN(A$)-I) ELSE B=0
340 C=C+B
350 NEXT
360 PRINT"DECIMAL EQUIVALENT ="C : RUN20
```

Program Listing

I have a Model I, 48K, three-disk drive system with double-density, lowercase modifications, and a Line Printer VII. I have a few problems that I can't seem to get anyone to answer.

First, when I run the RS MEMTEST, ROM A should return AE5D or AE60. Mine returns B078. ROM B should be either DA84 or DA45; mine is DA45. And ROM C should return 4002, 40BA, 3E3E, or 40ED. Mine returns 4006. Everything seems to be OK, but are these numbers correct?

Second, I can't get the 48K versions of Basic Programming Assistant by Instant Software and Packer by Cottage Software to load and run with TRSDOS 2.77D. When it loads, it checks to see if the lowercase modification is installed. If it is, it loads the lowercase driver, which apparently clobbers these programs. I don't know how to relocate, so do you know of a utility program that will help?

O.L.
North Little Rock, AR

Your first problem is that you're using an old version of the RS MEMTEST program. The values you

Continues on p. 349

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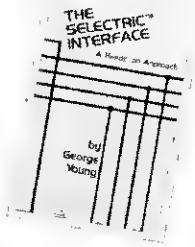

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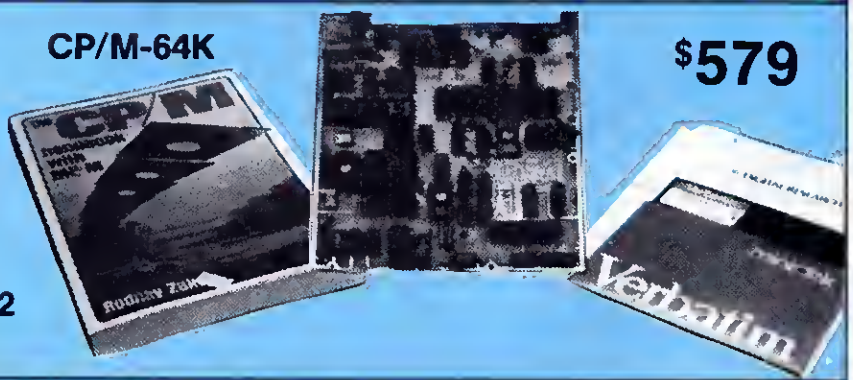

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Continued from p. 346

get are the correct ones for the revision A ROM, which powers up with Mem Size? instead of Memory Size?.

Your other problem is much more difficult. There isn't an easy way to relocate machine-language programs from one place to another, unless they've specifically been written to be relocatable. Some machine-language programs, when you load them, check to see what the highest available memory position is, taking care to respect HIGH$ (the DOS equivalent of a Memory Size). Usually these programs are loaded last. Unfortunately, neither of your two programs falls into this category.

Is there anyone who has a modified version of these programs that'll work with TRSDOS 2.77's lowercase driver installed?

I have an unmodified Model I with two disk drives and an Epson MX-80 printer. Before buying Electric Pencil, I called IJG and asked if it supports lowercase on an unmodified Model I. They said that it would, except that lowercase wouldn't be displayed on the screen. If I hit shift zero, a different set of characters is displayed on the screen. Lowercase prints on the printer, but how can you write in this manner? I wrote to IJG, but haven't received an answer.

The Pencil manual states on page one that I must make the lowercase modification to take full advantage of Pencil (direct contradiction of what I was told). The manual also states that there's a coupon at the back of the book for a Tenopak kit I can install. No coupon at the back of the book. Strike two!

I looked up some back issues of 80 Micro, *and installed the lowercase modification written by Dennis Kitsz in the December 1981 issue on p. 46. I made the modification as per his instructions, but it doesn't work: no lowercase displayed, strange symbols on the video, and lowercase to the printer. In addition, I now find that some graphics displays are messed up. Should the modification I made print lowercase on the screen when driven by Pencil? And if not, is there one that will? Also, how can I reach Teknopak?*

D.N.
Valparaiso, IN

Teknopak no longer sells the kit, but Progressive Electronics (537 E. Main St., Lancaster, OH 43130, 614-687-1019) is selling two versions of their kit. For those of you who've already made the modification but don't like the printed characters, you can buy the character generator chip alone for $18.95. It displays true upper/lowercase characters with proper descenders and no displaced letters.

For those who want the entire kit, it's available for $21.95 and contains the 2102 RAM chip, character generator chip, wire, and instructions for making the modification. The method Progressive uses is similar to the one used by Radio Shack: they jumper two wires, add the 2102 RAM to the video memory, and make one trace cut on the circuit board.

I talked with Dennis about the December issue modification. He has that modification in his own system, and uses Electric Pencil 2.0 as his word processor. He suggests that you carefully compare your work with the article instructions and check for solder bridges or cold solder joints that might not be connecting the wires properly.

I'd like to add a hex keypad, but the keyboard PCB already has the additional 12 key sockets wired in place which limits me to those 12 keys only. Do you have the part numbers for the switch set, caps set, and possibly the bezel?

My keyboard came from the factory with the following VCG chip installed in socket Z29: #SCM 37530 (AXX3027 or #8046673). From what I've read, this is the necessary character chip for the upper/lowercase modification. Is this right?

I'm also looking for a business program that's written specifically for an over-the-road trucker's accounting end of the business.

L.B.C.
Toledo, OH

Yes, you can buy the parts from National Parts (900 East Northside Drive, Fort Worth, TX 76102, 817-870-5662). The keyswitches (AS0992) cost $1.04 each, as do the keycaps. When ordering, tell the operator if the keyswitch is for the ALPS or Hitex keyboard (Hitex was the original keyboard, ALPS is the newer bounceless keyboard). There is no generic part number for the keycaps, you'll have to tell the operator the character you want. Installing all 12 switches costs you about $24 plus your time and labor.

What might be easier and cheaper in the long run would be to buy a 19-key Hex keypad (#K-19) from Jameco Electronics (1355 Shoreway Road, Belmont, CA 94002, 415-592-8097, $14.95), and install the keypad in parallel with your keyboard (see *80 Micro*, 80 Applications, September 1980, or *The Custom TRS-80* from IJG for details on this).

As far as my sources indicate, you have the correct chip. All you need to do is install the upper/lowercase modification and you'll be in business. See the previous letter for details.

Can anyone help L.B.C. with his business program need?

I have a cassette-based, 16K Model I Level II with RS lowercase modification, 16K Expansion Interface with buffered cable and a Line Printer VII.

When I turn the system on and start keying in a program, I sometimes notice that the text starts swaying back and forth, starting at the bottom and working its way to the top. At times it's mild, but other times the letters move over an entire position.

Is the problem with the video display or the video divider chain? I've also noticed that the video plug socket is loose, not the solder joints but the part the holds the pins from the DIN plug..

S.M.
Port Richey, FL

Your problem is caused by RFI from another source, not your computer. There's no real cure, unless you build a faraday cage around your computer (see the May 1983 column for more information). RFI is most commonly caused by light dimmers, fluorescent lights, neon lights, fading LEDs, and even motors (furnace, refrigerator, etc.) that are slightly out of specification.

The easiest way to track the RFI source down is to wait for it to manifest itself, then start turning off everything in the house. If you live in an apartment building, the trouble could be from someone else's faulty equipment. One

last word: your LPVII and keyboard both use an LED, but in these cases the trouble is almost always evident.

I've been doing a lot of work with the directory program of the TRS-80. I've found out how the password for a program is generated, but I would like to have a routine to decode the passwords. Can you help?

C.D.
Towson, MD

You don't say which computer system you're using. If it's a Model I, you're in luck: Instant Software (Peterborough, NH 03458, 603-924-9471) has a package called Disk Scope (#139) for the Model I disk-based computer containing a program that decodes the directory password for any program. It retails for $24.95.

I don't know of any package that operates like that for the Model III. Can anyone help with a Model III directory password decoder?

I'm using my double-disk-drive Model III with a Daisy Wheel II printer for word processing, using Scripsit with Acorn's Superscript patch. To earn additional income, I'd like to get into electronic typesetting. Is there software that inserts Compugraphic typesetting codes into my files? Do you know of any printers in New York City willing to accept ASCII files via modem, and then insert their own printing codes?

I'd also like to know if there's software available that will permit Model III users to communicate with the Westlaw data base. Westlaw tells me that they'll serve only Model II users. I understand there are compactors that'll give me 80 characters on my screen. If so, will this permit me to use Westlaw?

L.K.
New York, NY

Yes, you can use the Model III to send ASCII files to typesetting services. There're two ways that this can be done. The first works with almost any word processor, but depends on the typesetting service's computer for success. When you contact the service, they'll supply you with a chart of control codes that are simple character combinations (i.e., *B means boldface, *L means underline, etc.). You create your file just as you always do, using these codes in place of your word processor's print formatting codes. When the file is completed, save it in ASCII form and load a communications program. Then send the ASCII file to the typesetting service over the modem. As the file arrives at their computer, the computer uses a substitution table to replace the ASCII letter codes in your file with their corresponding typesetting control codes.

The other method requires a word processor, such as SuperScript, NewScript or LazyWriter, that can control codes in your file. When you contact the typesetting service, they'll give you a chart of typesetting codes used with their equipment. As you write your file, you put these codes directly into your file. When you're finished, save the file in ASCII format, load a communication program, and send the file to the service. When they receive it, they store it in their machines and print it out. Their equipment doesn't alter your file in any way.

Right off, I don't know of any companies in New York that offer this service, but more and more companies are joining this bandwagon so check the telephone book and make a few phone calls.

Finally, the "compactors," as you call them, are actually hardware boards that allow the video to display 80 characters by 24 lines. To use this capability, you must have the appropriate software to drive the hardware. TRSDOS and Basic can't do it. Most of these hardware boards are supplied with CP/M, which uses an 80 by 24 display and 64K of RAM. If you were to convert your Model III to CP/M capability, you should be able to use the Westlaw data base without difficulty since it won't recognize whether you're using a Model III or a Model II.

I purchased a 16K cassette-based Model III in August. Due to a lack of funds, I can't afford to upgrade to a disk system but I would like to go to 48K of memory. I don't want to send the machine out for a week, so please tell me how to do it myself.

K.V.
Mahopac, NY

It's no problem at all. You want to use 4116 RAM chips: the 200 nanosecond is fine, the 150 ns even better, and the 100 ns is best. Prices range from $12.95 for a set of eight from mail order firms to almost $32 if you buy them from Radio Shack (Radio Shack uses 250 ns memory). No other parts are needed.

Installing the chips is simple: unplug your computer and carefully remove the cover of your Model III (unscrew all the screws and lift the top off to the side). Locate the two rows of eight empty sockets on the circuit board. If you examine the board beneath the 16 empty sockets, you'll see that there are silkscreened outlines of the DIP packages. One end of each outline is marked with a notch. When you plug the memory chips in place, make sure that the notched end of each RAM chip lines up with the notch silkscreened on the circuit board. Be careful that you don't bend or fold any chip legs between the chip and the socket when you push each chip in place. The legs should position directly over the socket holes. If they're too far apart, gently roll the chip on a table top and bend the legs closer together. If they're too close together, gently pry them apart with a popsicle stick (avoid metal contact). If you're unsure of your abilities, get the Radio Shack inserter/extractor tool set (#276-1574, $6.95).

After installing the chips, inspect the chips and sockets closely. Check for bent chip legs and chips that are reversed in direction from the other chips. As a general rule, all chips on a circuit board are oriented the same way (notches all facing the same direction). Notes of caution: Opening your computer case voids your 90-day warranty. DO NOT touch the legs of the RAM chips with your fingers. Handle them by their ends only!

Put the case back together (don't put the screws in yet), plug in your computer and turn it on. In response to the message PRINT MEM, you should get something on the order of 48K. If you don't, check the memory chips. It's possible, but unlikely, that a chip is bad the first time you use it. When you get the 48K installed, run an all-night memory test program on the machine. If you're going to have memory problems, 90 percent of them will show up in the first 48 hours.

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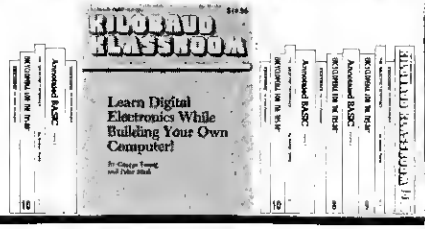

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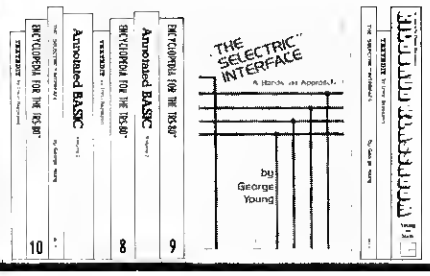

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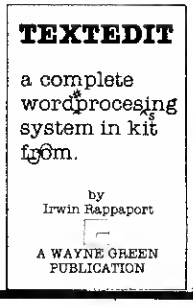

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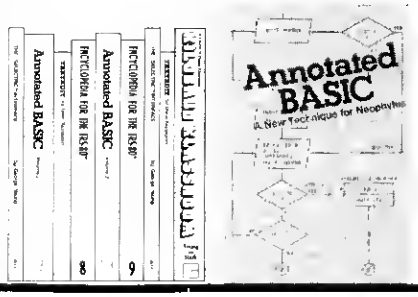

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My Model I works only at one's own risk. It's subject to disk reboots and syntax errors (which aren't there when the line is listed). The cable connectors have been cleaned.

I also have the same problem as D.S. of Austin, TX (February 1983, p. 406): My cassette tapes won't load. What do you suggest?

W.C.
Cary, NC

You don't mention the age of your computer or its Expansion Interface, so it's possible that your Expansion Interface is an earlier model that needs the buffered cable fixed or the MUX modification, or both. Both the reboot problem and the spurious syntax error result from the keyboard-to-Expansion Interface interface problem. Cleaning the contacts is the first step. If that fails, try lightly sanding the contacts with emery paper (unplug your computer, sand it, and then carefully and thoroughly clean the contacts after sanding). Check for a tight fit on the cable when you're finished. If the connector is loose, you might have to add solder to the circuit board edge connectors by lightly resoldering them.

Now test the computer. Set a disk program in memory and, while it's running, wriggle the keyboard/Expansion Interface connector several times. If you still get reboots or syntax errors, get Gold-Plug 80 connectors to replace the tin-lead edge connectors you now have (EAP Company, Box 14, Keller, TX 76248, 817-498-4242, $18.95 for the CPU/EI set of gold connectors).

If you have a tight fit on the connector, and the contacts have been thoroughly cleaned (and sanded if needed), the next choice is to check your RAM for defective bits. Several memory tests have been published in this magazine and many more are available on the market.

If you are still unsuccessful, take the computer to the RS computer center for a check. Explain the problem, tell the technician all that you have done to the computer and have him run his diagnostic programs.

I just purchased an LNW system expansion interface. When connected to my TRS-80 it shorts out the CPU power supply. On my friend's newer TRS-80 I found pin 37 and pin 39 to be ground on the keyboard expansion port. On my computer, pin 37 is ground and pin 39 is +5V. I tried cutting the trace on pin 39 and putting a jumper in to make it ground, but now I get @ on the screen and no boot.

A.C.
Euless, TX

Your problem is the jumper. The trace to pin 39 has to be cut. Remove at least 1/8 inch of the trace to prevent problems. Remove the jumper, too, as it's not needed. Next, carefully check the CPU board-to-keyboard cable. It's possible, if you took apart your computer to cut the trace, that you also

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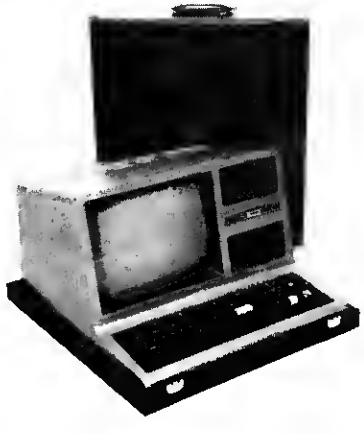

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pulled loose a connector to the keyboard. When this cable fouls up, all kinds of strange problems result, including no disk drive response, spurious resets, memory changes, and other equally weird behavior.

If you intend to modify your computer more than once or twice, do what the RS technicians do: buy an extra CPU to EI cable (non-buffered), cut slots in the sides of the connectors deep enough to allow the connectors to fit over the edge of the CPU circuit board, remove the keyboard/CPU cable, and use your modified CPU/EI cable to connect the keyboard to the CPU. The circuit pin spacing is just right to match the cable. The next time you take apart your computer, unplug the keyboard from the CPU. It takes most of the worry out of working on the CPU board.

It seems EPSET won't work with LDOS, although it does work with TRSDOS, MULTIDOS, NEWDOS, and DOSPLUS. I'm a confirmed LDOS user and therefore EPSET turned out to be a waste of money. Win some, lose some.

80 Micro *reviewed the Doughflo program (February 1983, p. 64), and according to the article, Alphanetics is going to make the program available without backup protection. I'm going to see if I can return my original disk for "unlocking." I still think the Doughflo program is great, I just can't chance using it without being able to back it up.*

E.S.
York, ME

As you said, win some, lose some.

I enjoy your column very much and I want to thank you for your kind words about my program Floppy Doctor. There are, however, a couple of things regarding the program you should be aware of.

There're two distinct versions, one for the Model I ($24.95) and one for the Model III ($29.95). The Model III version is more expensive because it has enhanced capabilities including hard copy error reports and a formatting test, among other things. The Model I version won't work on Radio Shack's double-density adapter, but it is compatible with Percom-like doublers. There are two separate programs supplied on each disk: the disk-test program and the RAM test program. Neither version works on any other computer, nor will either work on anything other than 5¼-inch drives. However, I believe they're the most inexpensive and comprehensive diagnostics available for the Model I and III computers.

One last thing: I no longer handle direct sales of the programs. Please contact either Apparat (4401 S. Tamarac Parkway, Denver, CO 80237, 303-741-1778) or Meta Technologies (26111 Brush Ave., Euclid, OH 44132, 800-321-3552, 216-289-7500).

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Anyone who needs a comprehensive disk/RAM diagnostic package for their Model I or Model III computer, I suggest that you get The Floppy Doctor. You won't regret it.

I'm writing in response to N.K.'s letter in the December 1982 Feedback Loop (p. 440). She was interested in audio output from a Model I for word processing for a blind person. A unit that'll get her started is the Microvox, available as a kit from MicroMint (917 Midway, Woodmere, NY 11598, $215 plus $4 shipping). The unit is available ready-to-go for $295 (plus $4) as the Intex-talker from Intex Micro Systems (Suite 1717, 755 West Big Beaver Road, Troy, MI 48084). The unit is described in detail in the September and October 1982 issues of Byte.

The unit has both serial and parallel outputs. I haven't used the serial output, but the parallel output works fine. Just unplug the printer from its cable to the TRS-80 and attach the Microvox instead. Anything sent to the printer port is now either spoken or spelled. This includes word processor outputs, LPRINTS, LLISTS, and so forth. N.K. must be prepared for some difficulty with the accent. It takes about an hour to get the hang of it (it's as rough as a strong West Indian accent). Nevertheless, it does read your material back to you, and has a good go at telling you what errors have been made, if you can get them to print. I use NEWDOS80, so a quick JKL will make the screen contents audible at any time.

For sighted users, Microvox isn't fast enough to be used for proofreading and the incomplete intonation control is tiring, but at $295 it's a bargain and should certainly help N.K.

Incidentally, if N.K. can get hold of a speech recognizer, such as the Cognivox from Voicetek ($149), she could arrange it so that certain commands from her would cause the computer to reply. This might be handy to find out whether the system is working or not. On my system, calling Fred gets the response Yes?, and Help starts an emergency phone dialing procedure, with a spoken commentary on what's happening for reassurance. The Microvox output is good enough to read prerecorded messages into a telephone.

Finally, N.K. should be aware of the information put out by the Trace Center for the Severely Handicapped at the University of Wisconsin, Madison. They have all kinds of information on computer programs and hardware for the handicapped. They are intended for home construction and use, and are fairly priced. Communication Outlook *is another excellent source and is published by the Artificial Language Laboratory, Computer Science Dept., Michigan State University, East Lansing, MI 48824.*

M.B.
Pierrefonds, Quebec

Thanks for the good advice and information.

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I upgraded my Model I to include the RS double-density board and TRS-DOS. I'm pleased with the increased disk storage capacity and the additional commands available, but there are three irritants in TRSDOS with which I'd like your help.

- *How can I modify the boot program to go directly to the TRSDOS Ready prompt instead of having to answer the Date and Time prompts first?*
- *How can I modify Debug to allow it to display memory below 5400H?*
- *How can I modify the Copy command so that it copies single-density to double-density with a one-drive system?*

D.C.V.
Scott AFB, IL

I'm sorry, but I don't know the patches that do what you want, especially the modification to the Copy command. I fear that that patch is very difficult.

What you should do, if you can afford it, is to buy another DOS that has the capabilities you want. I know that MULTIDOS, NEWDOS80 and DOSPLUS will let you use the Radio Shack doubler, and they don't have the drawbacks you complained about. But this is a rather radical solution to your problem.

Does anyone have the patches to double-density TRSDOS that D.C.V. wants?

The advent of the TRS-80 Model 16 and other 16-bit computers makes number-crunching (i.e., the execution of large-scale engineering programs and partial differential equation formulations) on microcomputers cost-competitive with minicomputers; but only if floating-point hardware co-processors are readily available and integrated into existing 16-bit microcomputer designs.

Inquiries to Tandy relative to this application haven't produced any useful response. I'm curious to know if a floating-point hardware option is likely for the Model 16 and if it's already available on other 68000-based microcomputers. Number-crunching micros will revolutionize heavy scientific computing to the extent that mainframe computer manufacturers should be worried.

C.A.J.F.
New South Wales, Sydney, Australia

As far as I know, there isn't a floating-point co-processor board for the Model 16, although I've heard rumors that the boards are being developed for the 68000. Mainframe manufacturers are worried about microcomputers. Why else do you think IBM introduced a personal computer and DEC is opening retail stores all over the place? ■

Terry Kepner is a freelance writer and programmer, and the vice president of Interpro. He's been writing about microcomputers since 1979.

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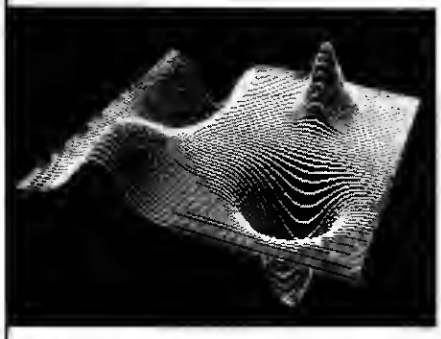

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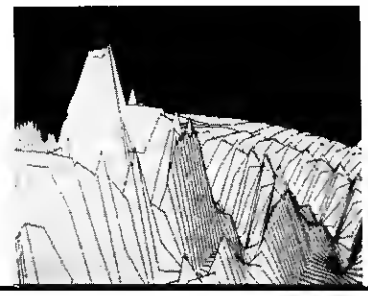

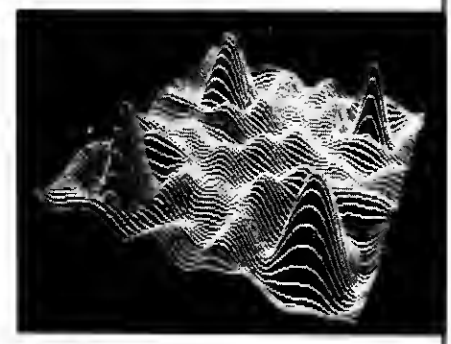

The Grafyx Solution package is shipped from stock and includes the board, 44 programs including an 80-Column display driver and Extended Graphics Basic, and a 54 page manual all for $299.95. The SURFACE PLOT program, twelve hi-res pictures, and manual is $39.95. Shipping is FREE on pre-paid or COD orders. (Tx. residents add 5% sales tax.)

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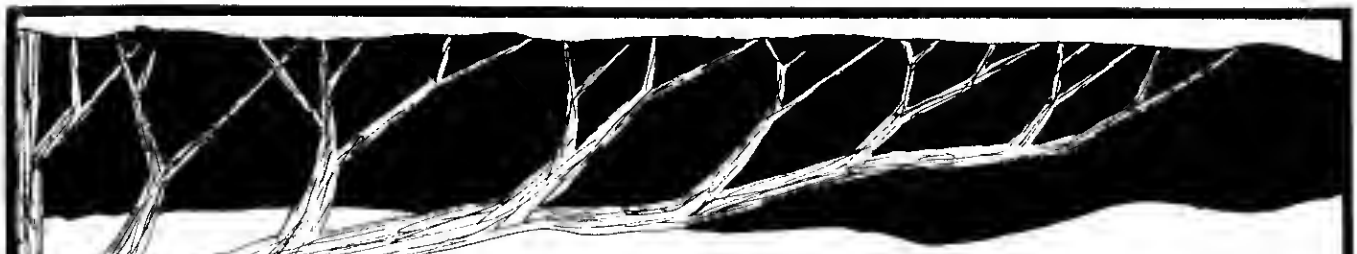

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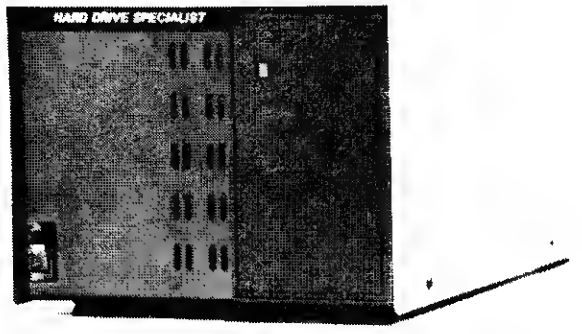

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NEW PRODUCTS

edited by Eric Grevstad

Newbasic

Newbasic 2.0 is an enhancement that adds up to 40 commands to Model I/III Disk Basic.

Over 10 graphics commands combine the speed of Assembly language with the ease of Basic, even for animation. Additional commands handle sound generation, RS-232 initialization and input/output, definable keys, line labeling, string execution, using a Do/Until loop, and more.

The Newbasic disk is $39.95 from Modular Software Associates, 209 18th St., Huntington Beach, CA 92648, 714-960-6668.

Reader Service ✓570

Upgraded Dot-Matrix

An enhanced version of Okidata's Microline 84 dot-matrix printer is now available. The Step 2 printer offers 200-cps bidirectional printing and a 50-cps correspondence mode with proportional spacing.

In addition, the unit is fully compatible with VisiCalc, WordStar, and other popular software packages, accepting them in correspondence mode with no modifications. Other improvements include select/deselect control, a Spanish character set, and forward-feed super- and subscript printing.

A Super Speed RS-232C interface provides switch-selectable transmission speeds of up to 19.2K baud and supports normal, correspondence, and graphics print data. Monitor and self-test modes provide diagnostic capabilities.

The Step 2 Microline 84 sells for $1,495 (serial interface) or $1,395 (parallel) from Okidata Corp., 111 Gaither Drive, Mt. Laurel, NJ 08054, 609-235-2600.

Reader Service ✓571

Screen Expander

The Screen Expander gives the 64K Color Computer a 51-by-24-character upper- and lowercase display for word processing, Extended Basic, and Assembly programs that use text displays. It includes an easy-to-use character editor and a PRINT@ command enhancement.

The program transfers ROMs to RAM and modifies them to use its high-resolution display. It does not affect any software, and is maintained even after resetting.

Price is $24.95 (cassette) or $29.95 (disk), plus $2 shipping and handling, from Computerware, Box 668, 4403 Manchester Ave., Encinitas, CA 92024, 619-436-3512.

Reader Service ✓561

L-Monitor

The L-Monitor is a tape-loading aid for the Model I that assures first-time program loads and precisely monitors program saves. It is attached between your micro and cassette recorder using standard 1/8-inch connectors (included), and is adjustable for individual computers.

An output for earphone, amplifier, or tape duplication is provided; instructions cover normal use of the L-Monitor as well as tips on tape head alignment and tonal balance.

An assembled and tested unit is $23.50, and a kit $17.50, from L-Monitor, 819 Kenyon Lane, Newark, DE 19711.

Reader Service ✓569

II/16 Telex Software

The SmarTelex package lets 64K Models II and 16 communicate with any telex terminal in the world. Its menu includes international (50 baud) and domestic telex, as well as the Easylink mailbox service and Autosafe store-and-forward.

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SmarTelex uses your word-processing program to create, delete, and edit messages. Telex utilities list all messages sent, to be sent, or received (with date and time). Other programs, such as a spreadsheet or accounting system, can be added to the main menu for no-reboot convenience.

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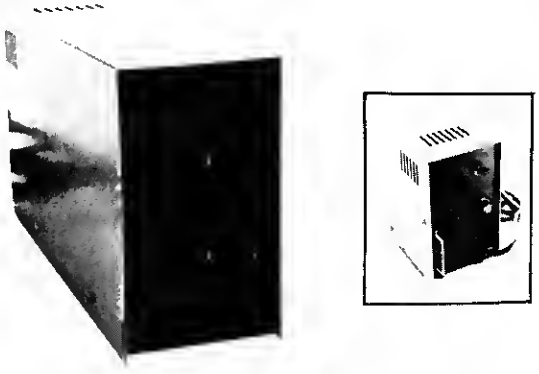

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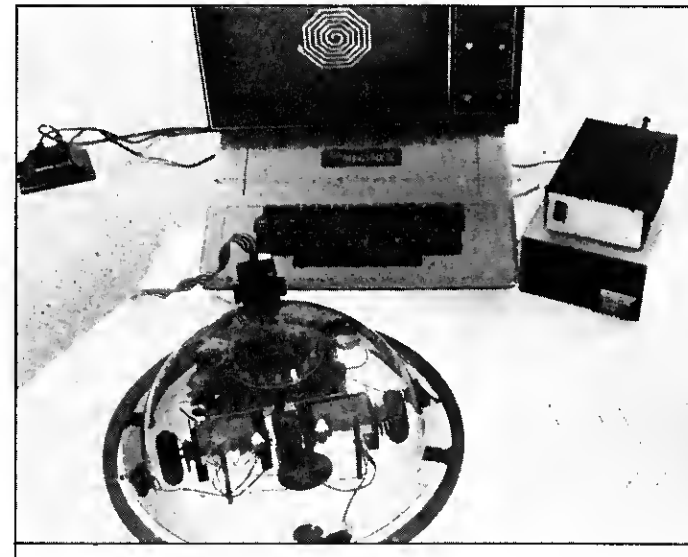


Tasman Turtle and Apple II

within five nanoseconds or less, and has an instant reset for uninterrupted protection.

Available in black, blue, ivory, and beige, the SL measures 3 by 3 by 3 inches and carries a 90-day warranty. It sells for $99 from Transtector Systems, E. 5250 Seltice Way, P.O. Box 1299, Post Falls, ID 83854, 800-635-2537.

Reader Service ↙577

Employee Scheduling Software

Sched:Planner is a Model III program that automates the process of creating and assigning weekly work schedules for large organizations. It also provides "what-if" analysis and forecasts alternate schedules, and can be used without computer experience.

The program handles up to 1,800 employees and up to nine separate schedules. Updating a weekly schedule for a worker takes less than a minute, with arrow keys and arcade-style graphics eliminating most typing. A composite schedule, automatically printed for each day of the week, displays a time line for each employee, showing when and at what assignment he or she will work.

Sched:Planner costs $750; Sentry, a high-security version designed for applications such as guard-force scheduling, is $850. For more information, contact Key-1 Computer Systems, 178 Spring St., Newport, RI 02840, 401-849-4053.

Reader Service ↙574

The Australian Crawl

The Tasman Turtle, a programmable robot beneath a clear plastic shell, has crossed to America after wheeling around Australia since 1980.

Directed by any microcomputer with a parallel or RS-232 interface, the Turtle moves and turns, toots its horn, blinks its eyes, draws with a pen, and "feels" through touch sensors. A talking Turtle, with a vocabulary of 150 words (expandable to over 600) and a Yankee accent, is available at extra cost.

Prices start at $999.95 from Harvard Associates Inc., 260 Beacon St., Somerville, MA 02143, 617-492-0660.

Reader Service ↙581

Help for LDOS

Users new to the LDOS operating system find that it lacks one important feature—

DOES STRING COMPRESSION HAVE YOU TIED UP IN KNOTS?

LET TRASHMAN CLEAN UP THE MESS!

TRASHMAN is a machine language utility for the TRS-80 Models I and III. It was written by Glenn Tesler, the author of FASTER, and can reduce BASIC's string compression time by 95% (see table below).

WHAT'S STRING COMPRESSION?

When a BASIC program changes a string (words, names, descriptions), it moves it to a new place in memory, and leaves a hole in the old place. Eventually, all available memory gets used up and BASIC has to push the strings together to free up some space. This takes time. Lots of time. The computer stops running for seconds or minutes, and you may even think it's "crashed". The keyboard won't work, and until all the strings have been collected, you just have to sit and wait. Then things run for a while, until string compression is needed again. And again.

If you're using your computer for business, that wastes your money. If you're using it personally, it wastes your time.

WHAT'S THE SOLUTION?

As soon as you start using TRASHMAN, those delays almost disappear. It uses less than 600 bytes of memory, plus 2 bytes for each active string. It works with other machine language programs and with all major operating systems. It's easy to use, comes with complete instructions, and can be copied to your own disks.

WHAT'S THE CATCH?

If a BASIC program uses only a few strings, very little time is wasted in string compression, and TRASHMAN won't be helpful. But, if hundreds of strings, including large string arrays, are used, TRASHMAN is just what you need.

# STRINGS	SECONDS DELAY NORMAL	SECONDS DELAY TRASHMAN	PERCENT IMPROVEMENT
250	11.8	0.7	94
500	45.8	1.6	96.5
1000	179.6	3.5	98
2000	713.2	7.8	98.9

TRASHMAN is available on disk for just **$39.95.**

ATTENTION SOFTWARE PUBLISHERS:
Trashman may be licensed for use with your packages. Call for details.

(All timings done on TRS-80 Model I. Model III 15% faster, but pct. improvements identical. Listing of timing program available on request.)

SAVE TIME WITH FASTER

"FASTER" speeds up most TRS-80 BASIC programs by 20-50%. It's helped hundreds of satisfied people and it can help you. Detailed instructions make it easy to use. FASTER analyses your BASIC programs *while they run*, then displays a simple change, usually one line, that sequences program variables so the ROM will find them faster.

You can use FASTER to speed up programs you've bought, as well as programs of your own. Since it isn't a compiler, your BASIC programs can be read and changed afterwards. FASTER works on business programs, models, and games. The more complex your program, the better the results.

Does FASTER really work? Yes! Just check the reviews in *Personal Computing*, May, 1981, p. 116: **"FASTER is effective and easy to use"**; 80 *U.S. Journal*, April, 1982, p. 106: **"I recommend FASTER to everyone"**; and 80 *MICRO* (April, 1982, p. 40): **"If you...would like a significant increase in the run-time speed, then buy FASTER."**

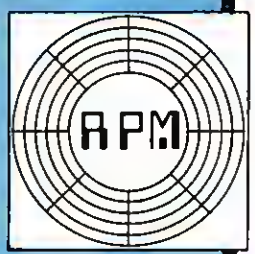
FASTER runs on the TRS-80 Models I and III, 16-48K tape or disk, and all major operating systems. **$29.95**

"QUICK COMPRESS" takes only 276 bytes of memory, and removes the blanks and remarks from even the largest BASIC program in less than 3 seconds. It produces smaller, faster programs without altering their logic.

$19.95

SPECIAL: FASTER and QUICK COMPRESS: **$39.95**

ERRATIC DISK DRIVES?



You can avoid unnecessary disk errors and repair hills by using **RPM.** This easy-to-use program measures the rotational speed and fluctuations of your disk drives, and warns you if they are running **too fast, too slow, or unevenly.**

Incorrect or erratic speed is a common cause of unexplained disk errors and loss of data. RPM's documentation explains how to **detect** and **correct** these problems quickly and easily. As *80 MICRO* (April, 1982, page 41) said: **"If your drives have problems I recommend RPM before paying to get it repaired."**

RPM is supplied on diskette for the TRS-80 Models I and III. We suggest you order a copy *before* you need it.

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TYPITALL

The *SCRIPSIT*™ Compatible Word Processor

TYPITALL is a new word processing program which is upward compatible with SCRIPSIT™ for the Model 1 and Model 3 TRS-80. If you already know how to use SCRIPSIT, you will be able to start using TYPITALL immediately. TYPITALL is the most advanced word processor available for the TRS-80 Model 1 and 3, and certainly the best bargain in word processors.

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- Enter hard spaces to make a sequence of words indivisible.
- Change words from upper to lower case, or vice versa, without retyping.
- Change key repeat speed.
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Disk version only — Specify Model 1 or 3 ..... $129.95
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- **RS-232-C Interface:** connector fault, data transmission, framing, data loop, baud rate generator.
- **Disk Drives:** disk controller, read data, formatting, read/write/verify all sectors woth or without erasing, disk drive timer, disk head cleaner.

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TRS-80 MOD III ASSEMBLY LANGUAGE

A complete course in assembly language.

This book is written for the **beginner** who has some knowledge of BASIC programming and wants to understand just how the Model III works. The book explains basic concepts of the computer, the Z-80 instruction set, complete Model III ROM and RAM information, and numerous practical programming examples, complete with programs you can type in and use for different purposes. Details of the Model III's disk controller, the TRSOOS 1.3 disk operating system, and RS-232-C interface are explained in detail.

The book contains a complete listing of Monitor #5, a comprehensive machine language monitor program including a disassembler, memory displays, memory search, compare and modify commands, disk and cassette input and output commands, RS-232-C commands, and a complete debugging package including the setting and displaying of registers, setting breakpoints, and single stepping through program instructions. MON-5 is also available in a Model 1 version.

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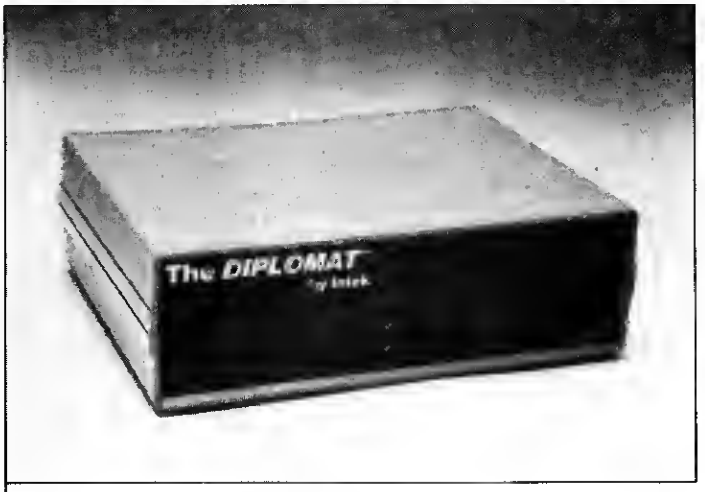


Diplomat Switch Box

a Help command. The LDOS Help utility, written in machine language, provides assistance. It displays the command format, a list of parameters, and the relevant page number in the manual.

The utility can be called from LDOS Ready or from LBasic using CMD"HELP (command)". If no command is specified, a list of all the commands and utilities is displayed.

Help is available for $19.95 plus $1.50 shipping and handling from Vinzant and Associates, P.O. Box 174, Hobart, IN 46342 (Indiana residents add 5 percent sales tax).

Reader Service ↙567

The Diplomat

The Diplomat, an intelligent interface switch box, lets you connect four devices to your TRS-80. Possible combinations include several microcomputers accessing one printer, or one micro and a variety of peripherals, regardless of whether serial or parallel. Any input device can be connected to one or more output devices through either software or hardware switching.

Besides handling RS-232 and parallel interfaces, the Diplomat can drive a Qume or Diablo-style printer directly, as well as translate printer protocols. An intelligent 16K RAM buffer (64K optional) divides its space among transmitting devices. Sixteen communication speeds, eight of which are switch-selectable, range from 50 to 19.2K baud.

The Diplomat measures 8.1 by 2.5 by 6.25 inches, and sells for $595 or more (depending on memory and options). It is available from Intek Manufacturing Co., 780 Charcot Ave., San Jose, CA 95131, 408-946-9041.

Reader Service ↙558

Color Talk to Me

Color Talk to Me is a voice-recognition program that uses your cassette recorder's condenser microphone as an input port for the Color Computer. Over 200 words can be stored in a 16K machine, and the manufacturer claims recognition accuracy of 80 to 90 percent.

The two-cassette software package includes the machine-language Color Talk to Me subroutine, a Basic subroutine to merge voice input with your existing programs, and two application programs: Screen Painter, which paints the screen in one of the CoCo's nine colors when the color is spoken; and Voice Calc, which listens to spoken arithmetic problems and displays the solution.

The price is $49.95 plus $2 shipping and handling from

ColorSoft Software Co., 11764 Raintree Court, Utica, MI 48087.

Reader Service ✓554

Model 16 Data Base

CCDS is a relational data base management system for the Model 16. Implemented in 68000 code, it uses menus and an English-subset query language. It supports single-access intelligent sequential, indexed sequential, hashed random, and pile files.

The program costs $595 from Data Management Systems, 211 N. El Camino Real, Suite 101C, Encinitas, CA 92024, 619-942-0744.

Reader Service ✓557

Protect Your Disks

Info-Guard is a disk envelope that protects floppies during transportation and storage. It shields disks from distortion or erasure due to electrical storms, power-generating equipment, airport security X-rays, or other electromagnetic interference.

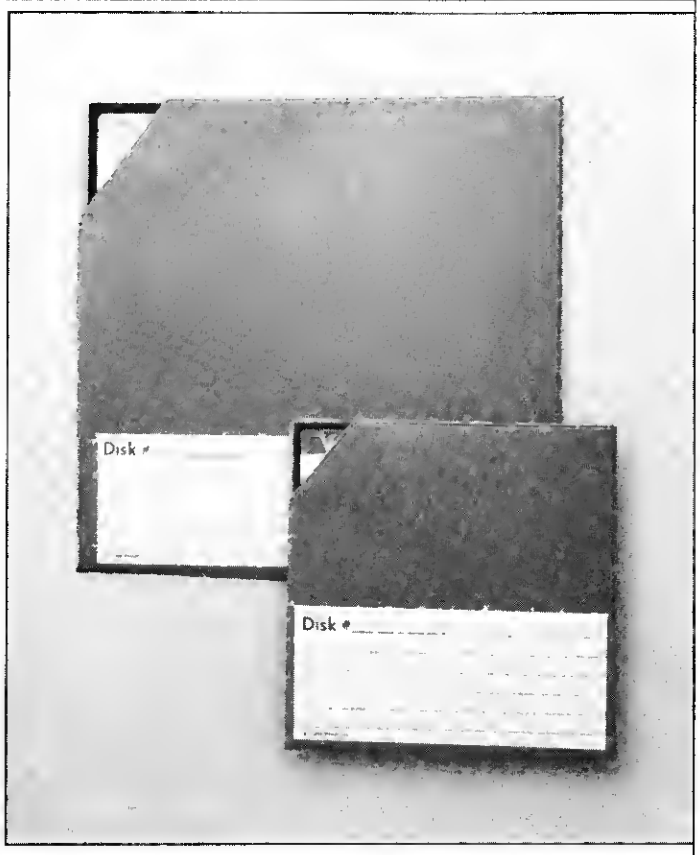
An 8-inch envelope is $14.50, and a 5¼-inch envelope costs $9.50, from C-Line Products Inc., P.O. Box 1278, 1530 E. Birchwood, Des Plaines, IL 60018.

Reader Service ✓575

Android Attack

Android Attack is a machine-language action game for a joystick-equipped Color Computer. The player runs through an infinite number of room patterns, earning extra points for getting the crown in each room and leaving before time runs out, while firing at and dodging fire from angry androids. Further complications include ghost androids, mines, and suit protection; the game's graphics allow you to jump or duck and to fire at angles.

Players choose from



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Written in Machine Language, but requires Extended or Disk Basic.

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Dennis Black ✓184

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Head Cleaning Kit

among 16 skill levels, with one to eight androids per room. Both 16K and 32K versions are included on the game cassette ($21.95) or disk ($25.95); the 32K version talks, with androids making such remarks as "Intruder alert" and "Human beware."

The game is sold by Spectral Associates, 141 Harvard Ave., Tacoma, WA 98466, 206-565-8483.

Reader Service ✓550

I/III Statistical Package

SPM (Statistical Package for Microcomputers) 2.2 is a versatile and flexible series of disk programs for the 48K Models I and III. According to the manufacturer, it supports features found in no other microcomputer statistical package, including non-linear regression, unequally sized groups for analysis of variance, and variables addition to multiple linear regression, complete with subcorrelation statistics.

The programs include descriptive statistics, one-way frequency analysis, and XY plots, pie charts, and histograms for the printer. Two file utility programs, Edit and Filetran, provide sophisticated editing and data manipulation, such as adding, changing, or deleting variables or scores, application of up to 17 mathematical transformations nested up to 30 deep, and transferring files from one structure to another.

The SPM package is $119.95, and individual programs are $39.95, from A-Priori Software, 1005 W. Main St., Vermillion, SD 57069, 605-624-4214. Add $5 for shipping and handling.

Reader Service ✓552

Clean Your Drives

Head Computer Products' disk drive cleaning kit includes two non-abrasive cleaning disks and a four-ounce bottle of cleaning solution. Running a cleaning disk in a drive for 30 seconds removes oxide deposits, smoke particles, and oil from the drive head.

The $7.50 kit lasts for 30 cleanings. It can be ordered from Head Computer Products Inc., 18533 Burbank Blvd., Tarzana, CA 91356, 213-342-9600.

Reader Service ✓553

Ready-Made Subroutines

Comsub is a collection of common subroutines for the 16K Model I/III Level II programmer. It serves as a skeleton of a program, to which you add applications-dependent routines, accessing the needed subroutines via GOSUB and a line number of over 1000. A five-second pause, for example, is called by setting a time variable (TM = 5) and coding GOSUB 1050, which accesses Comsub's pause routine.

The package's several dozen routines include tape I/O initialization and error handling, automatic lowercase shift, printer-ready check, printer column justification, full error message printout, Break and List enable/disable, and more.

The tape version ($10) includes two 500-baud copies of Comsub; the disk version ($15) is in Model I 35-track single-density format on a nonsystem disk. For more information, contact Practical Programs, 1104 Aspen Drive, Toms River, NJ 08753, 201-349-6070.

Reader Service ✓555

Cores-64

Cer-Comp (5566 Ricochet Ave., Las Vegas, NV 89110, 702-452-0632) has upgraded its Cores-9 editor/assembler package to fit 16K, 32K, or 64K Color Computers. The package leaves 3K, 19K, and over 52K of workspace on the machines respectively, and does not require a disk system.

The editor has over 25 commands, including string search and replace, line or block move or copy, and automatic line editing. The assembler supports the full complement of the 6809 instruction set with all addressing modes, as well as standard assembler directives.

The standard Cores-9 tape is $29.95; a Cores-64 upgrade for Cores-9 owners is $14.95; and the enhanced Cores-64 tape is $34.95. Add $2.50 for shipping and handling.

Reader Service ✓556

II/16 Disk Status

The Stat utility for the Models II and 16 displays disk name, type, and free space and directory status information for disks in all four drives, with each drive shown in a separate column.

The program also checks to see that the system still uses the primary directory. This is the only way to determine whether the system has switched to the alternate directory.

The price is $50 from Custom Software Services, P.O. Box 150, Porterville, CA 93258, 209-784-7966.

Reader Service ✓576

Two CoCo Keyboards

Two firms have introduced standard keyboards to replace what some consider the Color Computer's most serious deficiency.

Mark Data Products (24001 Alicia Parkway #226, Mission Viejo, CA 92691, 714-768-1551) offers the Super-Pro, a full-travel keyboard that retains the same layout and nomenclature as the original. The board costs $69.95; a $4.95 plug adapter is required for computers made after October 1982.

The WP keyboard from Spectrum Projects (93-15 86th Drive, Woodhaven, NY 11421, 212-441-2807) adds four user-definable function keys to the standard 53 keys

Continues on p. 368

EXPANDO

Utilities for your TRS-80* from Instant Software

SUPER>>TERMINAL

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TRS-80 Disk Mod I & Mod III 32K 5700RD **$95.00**

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ZSIM works on ROM as well as RAM since you don't need breakpoints to retain execution control (although breakpoint operation is also available). This is the best tool available to examine your code in DETAIL!
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The disk-based disassembler that automatically assigns labels to machine language program routines. Send the disassembly to your printer or save it on tape for editing and reassembly using Apparat's extension of EDTASM.
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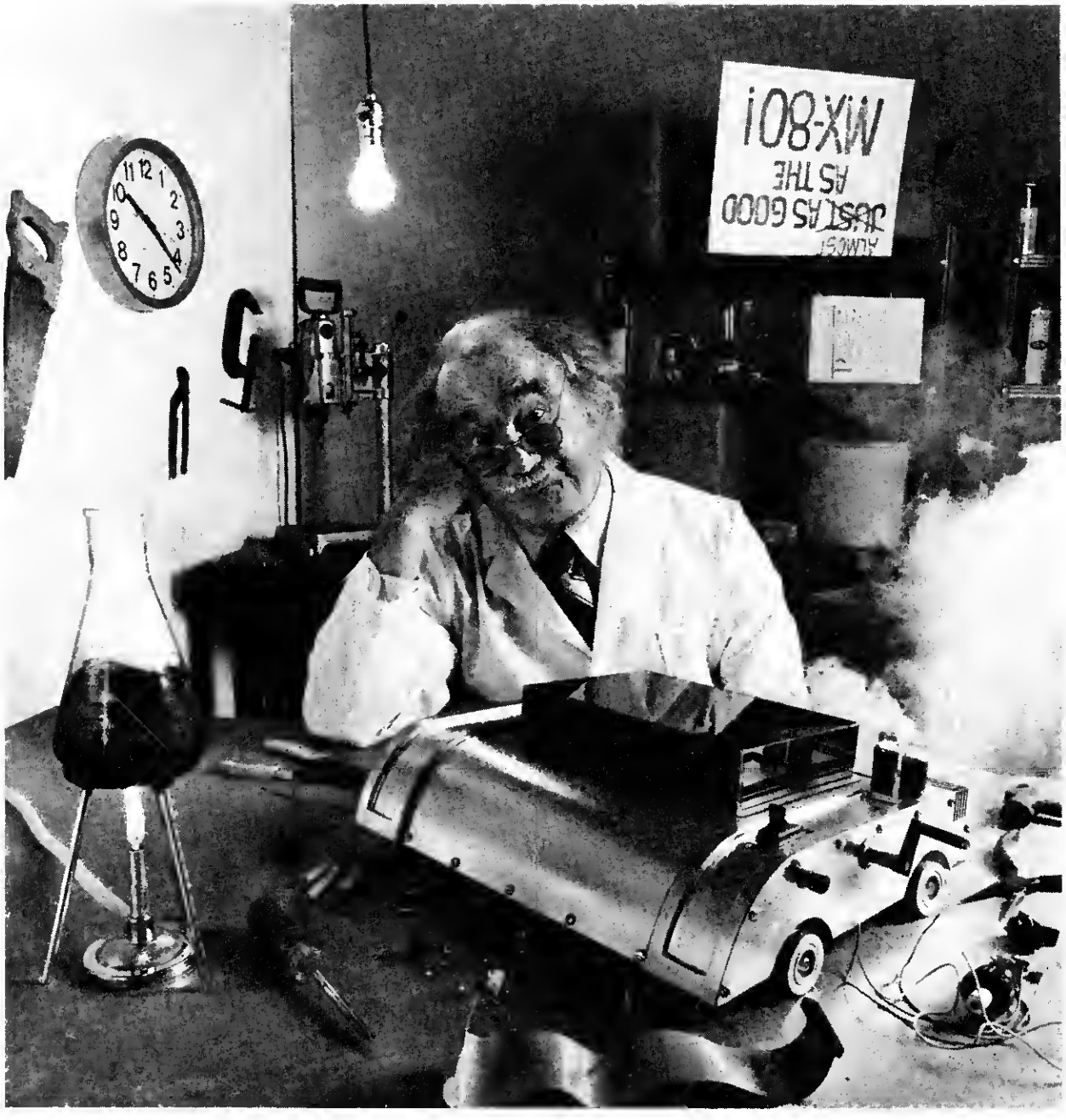

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The Epson MX-80 is the best-selling dot matrix impact printer in the world. It has been since its introduction. And despite the host of imitators it spawned, no one has been able top it. Until now.

FX-80: Son of a legend.
The new Epson FX-80 is far more than just doo-dads added on to last year's model. It's the most astonishing collection of features ever assembled in a personal printer.

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Bnt that hardly scratches the surface.

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With the new FX-80, yon aren't limited to ASCll characters. You can create your own. Any character or symbol that can be defined in a 9x11 matrix can be added to the FX-80's already impressive library of type styles and stored in its integral 2K RAM.

So you can create "Sally's Gothic" or "Tom's Roman" just by downloading and modifying standard characters. Or you can create a custom set from scratch. Either way, you can store up to 256 new characters. And if you don't need a new alphabet, the RAM functions as a 2K data input buffer.

Who knows graphics better than Epson?
Nobody, that's who. And if you don't believe it, witness the FX-80.

With a 12K ROM capacity, the FX-80 gives you a few things the others don't. For example, not one, not two, bnt *seven* different dot addressable graphic modes are program selectable. And can be mixed in the same print line. Everything from 72 DPI (dots-per-inch) Plotter Graphics to the 640 dots per line resolution designed to match the remarkable monitor clarity of the Epson QX-10 personal computer.

And *that* is in addition to an astonishing array of 136 different user-selectable type styles including Proportional, Elite and Italic as well as the more conventional faces you get on other printers.

Hard-to-beat hardware.
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The FX-80 features an adjustable pin platen or optional friction/tractor feed, so you can nse fanfold, roll or sheet paper ... backwards or forwards. The FX-80 even gives you reverse paper feed.

And if you're printing forms, the FX-80 has a feature you're gonna love: a function that allows you to tear off the paper within one inch of the last print position.

Be the first on your block.
We'd be willing to bet that the FX-80 — like the MX-80 — will have its share of imitators. Don't be fooled. To make sure you get the genuine article, rush down to your local computer store right now and let them show you everything the FX-80 can do.

And while you're there ... ask them to show you how it works with our computers.

97

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That's a tough question. I know, I asked it myself not very long ago. I'm Mike Motta. As president of Shawmut Systems, specialists in TRS-80* custom software, my customers were asking me for Model II and 16 Accounting Software — GL, AR, AP and Payroll. But I said "Why write the software. There must be a good package already available." So I searched for the best I could find. And I found it!

Now, when I tell you that these are the best Accounting programs I've seen on a microcomputer, you probably think that you are just listening to another sales pitch. But you're not. You're listening to a businessman with over twenty years combined experience in sales, management, and programming. So when I say that these programs will work for you, it really means something.

Each program, designed for the Model II or 16, will work with one or more floppy or hard disks. With each program, I'll include a 200 page manual written with the first time user in mind, and a set of sample data files so you can start using the program right away.

But I won't stop there. If you have a question, or a problem, call me. You won't get an operator, or order taker. You'll get me. And if I can't talk to you on the spot, I'll call you back. And I'll fix your problem. FAST.

Now I could say a lot more about these programs, but you really won't know how good they are until you try them. So, order the programs you need, and try them for 14 days. If you're not convinced that these are the programs for you, send them back, and I'll refund your money.

My price for these programs is only $289.00 each, postpaid. I could charge hundreds more, but I want you to have the best programs at the best possible price. So mail or call your order in today. I'll make sure you'll be satisfied.

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✓363

NEW PRODUCTS

Continued from p. 364

in QWERTY layout. Its price is $99.95.

Reader Service ✓565, 566

English Aid

Teachers' Friend, a series of educational programs for the Models I/III, teaches English as a second language to students who can read English at a second-grade level.

The 80 programs serve as a freestanding independent curriculum, but need not be followed sequentially. Each lesson teaches an English skill such as spelling, punctuation, parts of speech, syntax, or verb tenses. A lesson takes 10 to 15 minutes to complete, and each is geared to the student's rate of progress.

The lessons use six question formats, in personal and natural language. Students do not need microcomputer proficiency or typing skills.

Each Model I disk contains two lessons; each Model III disk, four. The price is $15 per lesson from The Soft Spot Ltd., 800 E. Arapaho, Suite 110, Richardson, TX 75081, 214-669-1779.

Reader Service ✓560

Color Market Analysis

Fundgraf is an investment analysis program for the 16K Extended Basic Color Computer. It allows graphics and/or numerical comparisions for any stock or fund for any period, and gives buy and sell signals based on the calculated moving average.

In addition, the program displays graphs of prices and annual growth rates, tabulates the change in price (adjusted for dividends) for any time period, and lets you compare funds by superimposing one graph on top of another.

The tape version ($49.95) supports files for seven funds or stocks and plots data for up to 70 weeks. For a greater number of stocks, simply make another file tape.

The disk version ($69.95) supports up to 52 funds and 200-week plots. A weekly file update requires about 10 and 15 minutes respectively.

Both are supplied with sample data for the Dow Jones Industrial Average and several mutual funds, and are available from Parsons Software, 118 Woodshire Drive, Parkersburg, WV 26101, 304-424-5191. Add $2 for postage and handling.

Reader Service ✓562

Faster Cassette I/O

Leader Lopper, a utility for the Model I, reduces cassette input/output time by up to 80 percent, with average savings of approximately 55 percent, according to the manufacturer. It requires just 17 bytes of run-time memory, is totally invisible to your programs, and requires no hardware or software modifications.

The program sells for $10.95 from Kensoft, 2102-50th St., Kenosha, WI 53140, 414-654-2722.

Reader Service ✓568

Economical Modem

The Comstar Research modem operates at up to 300 baud half-duplex (send and receive). It communicates in the originate mode, so you can talk to host systems.

The modem uses the Model I cassette port, needing no expansion interface or RS-232. Model III and Color Computer versions are forthcoming.

With software included, it sells for $99.95 from Comstar Research, P.O. Box 771, Madison Heights, MI 48071, 313-541-4840.

Reader Service ✓584

Pocket Spreadsheet

Super SST is the first spreadsheet program for the Pocket Computer that uses machine-language routines

for fast operation. A typical 10- by 14-cell matrix can be analyzed in as little as 10 seconds; dozens of "what-if" projections can be made within five minutes.

The program is available on tape for the PC-2 Pocket Computer with 8K memory expansion module. A CE-150 or equivalent printer/cassette interface is required.

The price is $49.95 ($59.95 U.S. in Canada and Mexico, $69.95 U.S. elsewhere) from *The Pocket Computer Newsletter*, P.O. Box 232, Seymour, CT 06483, 203-888-1946.

Reader Service ✓573

Pictures from VisiCalc

Datagraph transforms VisiCalc data into high-resolution scatter, line, or bar graphs. It accepts 1,000 data points and plots multiple data sets per graph, using custom symbols and line shapes.

The program plots data stored by VisiCalc or the user's own program using the DIF format. It features auto scaling, grid selection, text label entries, and selectable graph sizes from one square inch to 7 by 24 inches.

Datagraph ($79.95) is available for the 48K Models I and III with Epson, NEC, C. Itoh, IDS, Okidata, or Radio Shack VIII/DMP-200 printers. A Colorplot version for the IDS Prism is $89.95.

For more information, contact Micro Software Systems, 1815 Smokewood Ave., Fullerton, CA 92631, 714-526-8435.

Reader Service ✓564

Armdroid I

The Armdroid I, a robot arm for educational and hobby use, is available from Colne Robotics. The arm has five axes of rotation (base, shoulder, elbow, wrist up, wrist down, and wrist rotate) and a three-finger gripper; it lifts up to 10 ounces, has a gripping force of five pounds, a 17-inch reach, and a resolution of 0.15 inches.

The firm plans to introduce accessories such as vision and tactile sensors for improved control. The Armdroid interfaces to a latched 8-bit parallel port. It sells for $745 in kit form and $895 complete. Software for the Models I and III (and other micros) is available at extra cost.

For more information, contact Colne Robotics Inc., P.O. Box 23416, Fort Lauderdale, FL 33307, 305-566-3101.

Reader Service ✓551

I/III Communications System

Ultra Term is a versatile, easy-to-use communications program for the Model I or III with any TRSDOS-compatible operating system. It features an intelligent terminal program, a self-relocating host program, and hex conversion utilities for bulletin-board downloading. The package supports any manual or auto-dial modem that accepts commands through the RS-232 port or by pulses on the RTS line or casssette relay.

A direct-to-disk file transfer allows full control from the transmitting computer, and unattended operation at the receiving end. The terminal mode's split-screen feature lets you type outgoing messages on the bottom half of the screen while incoming messages appear on the top.

The system supports both half and full duplex, lets you use printers on systems that don't send nulls after carriage returns, and allows up to a 33K input/output buffer for universal-format ASCII file transmission.

It sells for $59.95 from United Software Associates, 734 Flamingo Way, North Palm Beach, FL 33408, 305-965-3496.

Reader Service ✓579

Make them or take them with LYNX — the total telecommunications system for your TRS-80 Model I or III. Access time-sharing systems. Free "bulletin boards." Electronic mail and news. Other micros. Gamers. Hardware, software and documentation — all for one price. Get your paws on it!

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✓ See List of Advertisers on Page 339

TouchMat

Flat Anti-Stat Mat

Even when you don't see or feel a spark, you may be carrying static electricity that can damage your computer. TouchMat, a three-layer static dissipative mat, lies beneath the computer, safely draining electricity via a grounding cord. Any time your hands or wrists rest on the mat, discharge is automatic.

Besides deterring static, TouchMat's cushioning material dampens noise and vibration and keeps the computer from sliding on the desktop. It is available in beige or medium brown, in 18-by-26-inch or 24-by-26-inch sizes.

Price is $89 from Computerware Inc., 315 S. Third St., Stillwater, MN 55082, 800-328-0223 or 612-430-2060.

Reader Service ✓580

EPROM Programmer

Boulder Logical Testing Inc. (P.O. Box 902, Boulder, CO 80306) has an EPROM programmer available for under $200 less cabling and connectors.

The programmer handles the 2716, 2732, 2732A, and 2532 EPROMs, and runs at any of four baud rates through the RS-232 port (110, 300, 1,200 and 9,600 baud). Its instruction set converts ASCII hexadecimal numbers to binary values internally; instructions include list, program, change byte, verify, and dup.

The unit comes assembled and tested, with its own power supply. Specifications for cabling and software interface are included.

Reader Service ✓583

New Cassette Software

A new line of software for non-disk Models I, III, and Color Computers is available from Futureview Inc.

Their business programs, such as Check Systems ($24.95), Electric Bookkeeper ($49.95), and Sales/Inventory ($49.95), feature a machine-language speed sort routine. They handle data in RAM, storing information to cassette only at the end of the work period.

Other programs range from a computer typing course ($19.95) to arcade-style games like Giant Space Slug and Wormhole ($19.95 each). For a catalog, send a stamped, self-addressed envelope to Futureview Inc., P.O. Box 101, Joplin, MO 64802; phone orders can be placed at 417-781-6999.

Reader Service ✓563

CoCo Voice Hardware

Unlike software speech programs that use the computer as a makeshift synthesizer, the Color Computer Voice is built around a large-scale integrated circuit, the Votrax SC-01. It reproduces any of 64 phonemes in four inflections.

Speech is channeled through the user's TV speaker or an external speaker connected to the built-in audio amplifier. A phono connector and volume control are provided.

The Voice is completely memory-decoded, so it does not conflict with the Radio Shack disk controller. Disk owners with an expansion interface produce speech with the Voice in one slot and the controller in another.

Assembled, tested, and supplied with software and manual, the Voice costs $179.95 from Speech Systems, 38 W. 255 Deerpath Road, Batavia, IL 60510, 312-879-6880.

Reader Service ✓582

DIFFERENT TRACK

Allied Micro-Pak

SCM Allied Paper, a division of SCM Corp. (the Smith-Corona people), wins this month's New Products spotlight with a bold debut in "the consumables segment of the micro aftermarket"—in other words, printer paper.

Current projections put this market at $36 billion in eight years, says SCM, a large part of that involving the home or small-business user. Until now, such users had to purchase and store continuous forms in huge quantities. SCM's innovation is the Micro-Pak—an easy-to-handle, plastic-wrapped ream, compared to the less convenient and affordable carton.

Forms available in Micro-Paks include two- and four-part carbonless blank forms; bar forms in bond, two- and four-part carbonless sets; and letterhead-quality white bond with clean perforations for a smooth edge. They are available at office supply and stationery stores, or from SCM Allied Paper, Business Forms Division, P.O. Box 125, W. Carrollton Branch, Dayton, OH 45449, 513-866-7421.

Reader Service ✓572

New Products listings are based on information supplied in manufacturers' press releases. 80 Micro *has not tested or reviewed these products and cannot guarantee any claims.*

YOU WILL NEVER AGAIN HAVE TO WASTE TIME WAITING FOR YOUR PRINTER.

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Microbuffer will instantly increase your efficiency — and eliminate the frustration of waiting for your slowpoke printer.

Now you can simply dump your printing data directly to Microbuffer and *continue processing.* Microbuffer accepts the data as fast as your computer can send. It stores the data in its own memory buffer, then takes control of your printer.

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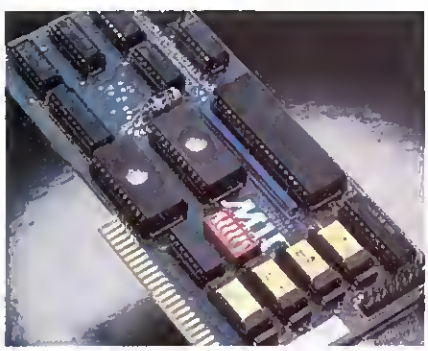
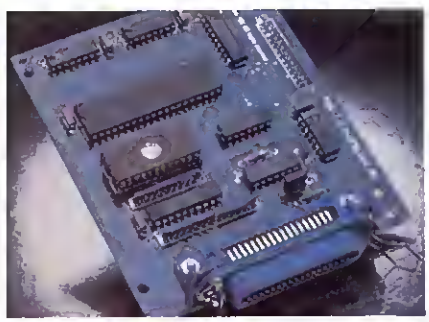
Whatever your system, there is a specific Microbuffer designed to accommodate it.



FOR APPLE II COMPUTERS, Microbuffer II features on-board firmware for text formatting and advanced graphics dump routines. Both serial and parallel versions have a power-efficient low-consumption design. Special functions include Basic listing formatter, self-test, buffer zap, and transparent and maintain modes. The 16K model is priced at $259 and the 32K, at $299.



FOR EPSON PRINTERS, Microbuffer/E comes in two serial versions — 8K or 16K (upgradable to 32K) — and two parallel versions — 16K or 32K (upgradable to 64K). The serial buffer supports both hardware handshaking and XON-XOFF software handshaking at baud rates up to 19,200. Both interfaces are compatible with standard Epson commands, including GRAFTRAX-80 and GRAFTRAX-80+. Prices range from $159 to $279.

ALL OTHER COMPUTER/PRINTER COMBINATIONS are served by the stand-alone Microbuffer In-line.

The serial stand-alone will support different input and output baud rates and different handshake protocol. Both serial and parallel versions are available in a 32K model at $299 or 64K for $349. Either can be user-upgraded to a total of 256K with 64K add-ons — just $179 each.

SIMPLE TO INSTALL.

Microbuffer II is slot-independent. It slips directly inside the Apple II in any slot except zero.

Microbuffer/E mounts easily inside the existing auxiliary slot directly inside the Epson printer.

The stand-alone Microbuffer is installed in-line between virtually any computer and any printer.

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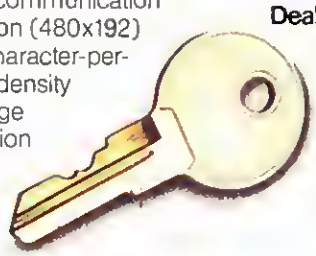

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